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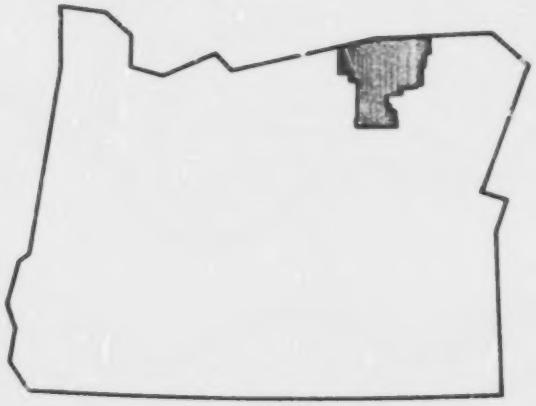
FLOOD INSURANCE STUDY

UMATILLA COUNTY, OREGON
UNINCORPORATED AREAS



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MARCH 4, 1987
REVISED:
JULY 15,1988

COMPLETED

Federal Emergency Management Agency

COMMUNITY NUMBER - 410204

ORIGINAL

NOTICE TO
FLOOD INSURANCE STUDY USERS

Communities participating in the National Flood Insurance Program have established repositories of flood hazard data for flood plain management and flood insurance purposes. This Flood Insurance Study may not contain all data available within the repository. It is advisable to contact the community repository for any additional data.

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Flood Insurance Rate Map

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1.0 INTRODUCTION

1.1 Purpose of Study

This Flood Insurance Study revises and updates a previous Flood Insurance Study/Flood Insurance Rate Map for the unincorporated areas of Umatilla County, Oregon. This information will be used by Umatilla County to update existing flood plain regulations as part of the regular phase of the National Flood Insurance Program (NFIP). The information will also be used by local and regional planners to further promote sound land use and flood plain development.

In some states or communities, flood plain management criteria or regulations may exist that are more restrictive or comprehensive than the minimum Federal requirements. In such cases, the more restrictive criteria take precedence and the State (or other jurisdictional agency) will be able to explain them.

1.2 Authority and Acknowledgments

The sources of authority for this Flood Insurance Study (FIS) are the National Flood Insurance Act of 1968 and the Flood Disaster Protection Act of 1973.

The hydrologic and hydraulic analyses for this study were performed by the U.S. Army Corps of Engineers (COE), Walla Walla District, for the Federal Emergency Management Agency (FEMA), under Inter-Agency Agreement Nos. IAA-H-2-73, IAA-H-2-19-74, and IAA-H-3-16-75, Project Order Nos. 4, 6, and 18, respectively. This study was completed in April 1976.

The hydrologic and hydraulic analyses for portions of the Umatilla River, Patawa Creek, South Fork Walla Walla River, and Birch Creek were performed by the COE for FEMA under Inter-Agency Agreement No. EMW-E-1153, Project No. 1, Amendment 18. This work was completed in June 1985.

1.3 Coordination

This study has been coordinated with the Oregon Water Resources Department and the Umatilla County government.

A final coordination meeting was held on March 9, 1976, and was attended by representatives of the COE, FEMA, and the County. The study was presented and accepted.

This FIS was revised in 1985 to add detailed study information along the Umatilla River in the vicinity of the Cities of Hermiston and Pendleton, Patawa Creek, and South Fork Walla Walla River. Approximate study information was added along Birch Creek. Flood boundaries on the Umatilla River downstream of Stanfield were also revised.

The final community coordination meeting for this revised FIS, attended by representatives of FEMA and the County, was held on February 25, 1986. No problems were raised at that meeting.

2.0 AREA STUDIED

2.1 Scope of Study

This Flood Insurance Study covers the unincorporated areas of Umatilla County, Oregon. Not included in the study are the incorporated municipalities of Umatilla, Hermiston, Stanfield, Pilot Rock, Adams, Ukiah, Athena, Weston, Milton-Freewater, Helix, Echo, and Pendleton. The Umatilla National Forest, Umatilla Indian Reservation, Cold Springs National Wildlife Refuge, and the McKay Creek National Wildlife Refuge were also excluded from the study. However, flood information has been provided from the McKay Creek National Wildlife Refuge, although it does not fall under the land use authority of the county. The area of study is shown on the Vicinity Map (Figure 1).

The following streams were studied by detailed methods: Umatilla River between Hermiston and Nolin and in the vicinity of Pendleton; Stage Gulch in the vicinity of Stanfield; McKay, Tutuilla, Patawa, and Wildhorse Creeks in the vicinity of Pendleton; Waterman Gulch in the vicinity of Athena; Walla Walla River in the vicinity of Milton-Freewater; South Fork Walla Walla River in the vicinity of County Road 600; and Mill Creek at the county limits.

The areas studied by detailed methods were selected with priority given to all known flood hazard areas and areas of projected development or proposed construction through June 1990.

Two sections of the Umatilla River and sections of Wildhorse, Birch, East Birch, Ownes, and Camas Creeks were studied by approximate methods because no notable development is foreseen near these areas through June 1990.

Approximate analyses were used to study those areas having a low development potential or minimal flood hazards. The scope and methods of study were proposed to, and agreed upon by, FEMA, the COE, and Umatilla County.

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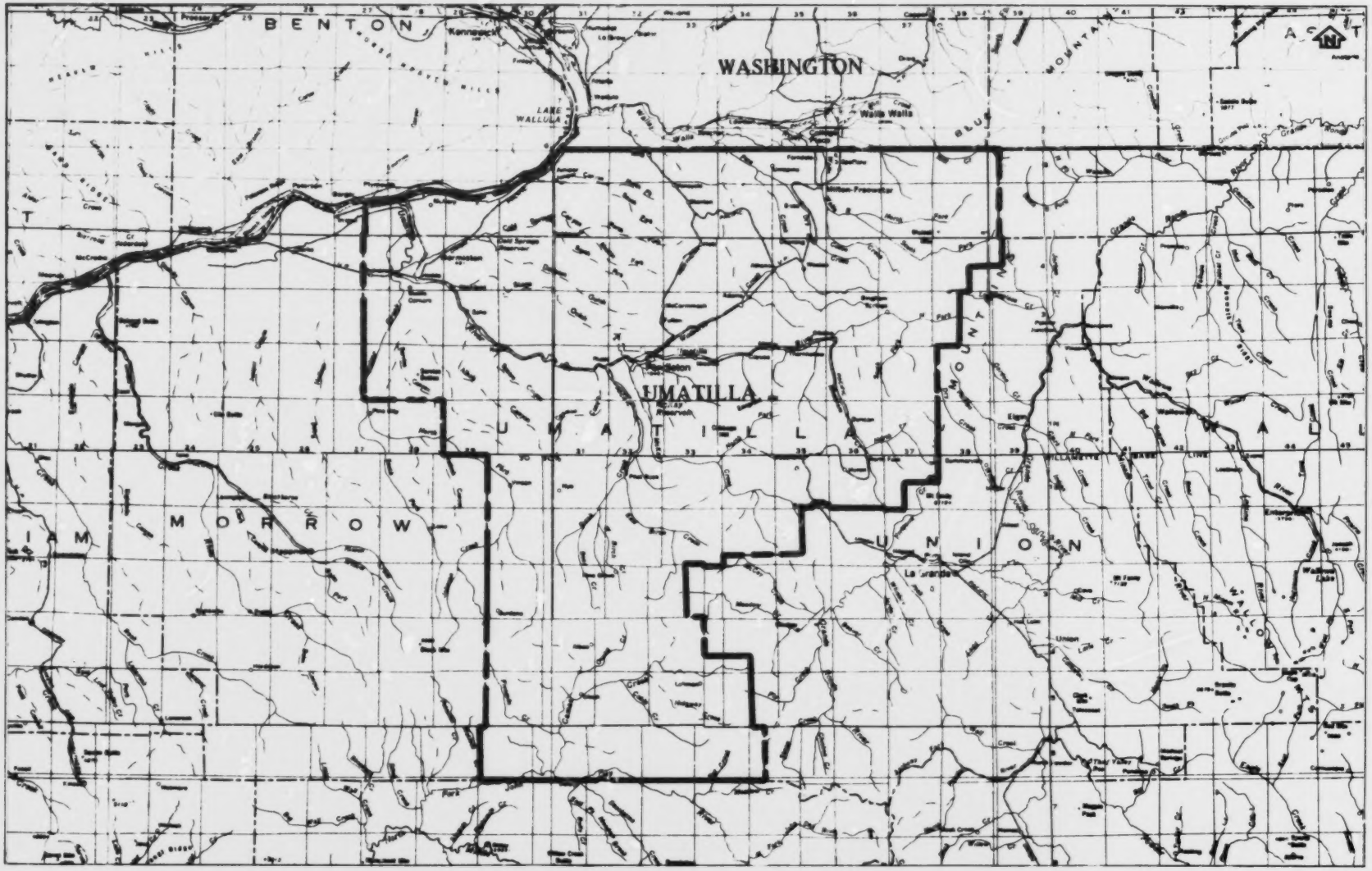

FIGURE 1

FEDERAL EMERGENCY MANAGEMENT AGENCY

UMATILLA COUNTY, OR
(UNINCORPORATED AREAS)

APPROXIMATE SCALE

16 0 16 32 48 MILES

VICINITY MAP

2.2 Community Description

Umatilla County comprises a 3,240-square-mile area in northeastern Oregon, approximately 180 miles east of Portland. In 1970, the population of the county was 45,000. A slow rate of population growth is expected for the county.

The Umatilla River is a tributary of the Columbia River and is the major drainage basin in the county. In Umatilla County, the river flows west to Nolin, then northwest to Cottonwood Bend, then north to its confluence with the Columbia River.

Stage Gulch originates in the hills southeast of Stanfield and flows northwesterly to its confluence with the Umatilla River just west of Stanfield.

McKay Creek originates on the northern slopes of the Blue Mountains, in the southeastern part of the Umatilla River basin, and flows 29 miles northwesterly to its mouth in western Pendleton.

Tutuilla Creek originates on the northeastern slopes of Emigrant and Cabbage Hills in the Blue Mountains and flows northwesterly 15 miles to its confluence with the Umatilla River at Pendleton.

Patawa Creek originates in the hills east of Pendleton and flows westerly to its confluence with Tutuilla Creek.

Wildhorse Creek, the only major northside tributary of the Umatilla River, originates on the western slopes of the Blue Mountains and flows southwesterly to its mouth at Pendleton.

Waterman Gulch originates north of Athena and flows southerly to its confluence with Wildhorse Creek.

The Walla Walla River is also a tributary of the Columbia River. Within the study area, the river flows northwesterly to Milton-Freewater and north to the Oregon-Washington State line.

The South Fork Walla Walla River originates in the Blue Mountains and intersects with the North Fork Walla Walla River southeast of Milton-Freewater.

Mill Creek originates in the Blue Mountains and empties into the Walla Walla River west of the City of Walla Walla.

The topography in Umatilla County ranges from mountainous terrain in the southern part to high, rolling prairies in the north.

The climate of the Umatilla River basin is characterized by light to moderate precipitation and an extreme range in temperature. In general, the climate is subject to the moderating influence of the

prevailing westerly flow of maritime air from the Pacific Ocean, but occasional influxes of polar airmasses cause brief periods of extremely cold temperatures. Record extreme temperatures within the county are 119°F at Pendleton and -52°F at Meacham.

The seasonal distribution of precipitation is similar to that generally observed over the interior of the Pacific Northwest, the greater portion falling during the winter. The average annual precipitation at Pendleton is 13.6 inches. Nearly 60 percent of the recorded annual precipitation falls from November to March.

High flows on the Umatilla River and tributaries generally begin in February and last through June. The prevailing low-summer flows are increased during the late fall and early winter by rainfall and melting of low-elevation snow. November, December, and January often have brief periods of high flows because of heavy rain and melting snow caused by unseasonably warm temperatures. Major floods in the basins result from rainfall or a combination of rainfall and snowmelt.

The largest portion of the Umatilla River flood plain is devoted to agricultural and related purposes. Development within communities located partially within the flood plain is primarily commercial and residential. Most of the flood plain along Wildhorse Creek is in open-type agricultural land, although suburban developments and farmsteads exist. Land use in the Tutuilla Creek and McKay Creek flood plains includes residential development and agricultural land use, with limited commercial development in the McKay Creek flood plain. Development in the Mill Creek flood plain is mainly residential, which includes lots for summer homes and cabins. Agricultural land use predominates in the Walla Walla River flood plain. Among other developments in Umatilla County, city streets, highways, and railroad lines cross the flood plains. Development is expected to continue within the study area, accompanied by continued pressures to intensify flood plain use.

2.3 Principal Flood Problems

Damaging floods have occurred in the study areas of the Umatilla River in 1882, 1906, 1908, 1913, 1921, 1931, 1932, 1937, 1946, 1949, 1958, and 1965. Of these, the December 1882 flood was the highest of record.

Floods are usually caused by a combination of rainfall and snowmelt. When snowmelt augments rainfall runoff, the floods have both high peaks and large volumes; however, damaging stages seldom last longer than 1 or 2 days. Floodflow stages can rise from normal flow to extreme flood peaks in a relatively short time, with high velocities in the main channel of the streams.

Bottom lands in the study areas of McKay and Tutuilla Creeks are subject to flooding from high flows. Velocities up to 5 feet per

second can be expected in the flood plains of these creeks. The February 1949 flood is among the largest known for Tutuilla Creek, with an estimated peak discharge of 2,500 cubic feet per second (cfs). The 1904 flood was the most serious, according to the U.S. Soil Conservation Service; however, no additional data are available.

The February 1949 flood is among the largest known for Wildhorse Creek, with an estimated discharge of 10,000 cfs, which is slightly higher than the 100-year flood (9,600 cfs). On McKay Creek, the April 1958 flood is the largest to have occurred below the reservoir of McKay Dam since its completion in 1926. It had a maximum release of 2,520 cfs.

Mill Creek is subject to flash floods of relatively short duration. High flows occur during the winter and spring, and may be caused by intensive rainstorms, excessive snowmelt, or a combination of rainfall and snowmelt. Flooding on Mill Creek is frequent. Flows in excess of bankfull (600 cfs) have occurred 29 times during 36 years of record. The maximum flood of record on Mill Creek occurred in March 1931. Streamflow records were not being kept at that time; therefore, the flood discharge and stage data are not available.

The Walla Walla River has experienced flooding in 1906, 1931, and 1965, with the two largest occurring in April 1931 and January 1965. High velocities of 14 feet per second can be expected in the flood plain.

Approximately 17,600 acres along the Umatilla River main stem and 12,000 acres along tributary streams are subject to flooding. Natural obstructions to floodflows include trees, brush, and other vegetation growing along the streambanks in flood plain areas. Manmade encroachments either on or over the streams, such as bridges, create more extensive flooding than would otherwise occur.

2.4 Flood Protection Measures

Flood-prevention measures in Umatilla County are limited to those constructed locally and by the COE or other Federal agencies under emergency conditions. These improvements are not considered either permanent or adequate to provide protection against floods of the 100-year magnitude.

Levees exist in the study area that provide the community with some degree of protection from flooding. However, it has been ascertained that some of these levees may not protect the community from rare events such as the 100-year flood. The criteria used to evaluate protection against the 100-year flood are 1) adequate design, including freeboard, 2) structural stability, and 3) proper operation and maintenance. Levees that do not protect from the

100-year flood are not considered in the hydraulic analysis of the 100-year flood plain.

The principal water storage project is McKay Dam and Reservoir, located upstream from Pendleton. This project is operated for irrigation, and any flood control is incidental. A flood plain zoning ordinance is in effect for the unincorporated areas of Umatilla County.

Flood forecasts are made for the Umatilla River and tributaries at Pendleton by the Office of the National Weather Service, River District, in Portland, Oregon. Forecasts are issued to the State and County Civil Defense Directors and are disseminated in the area by the office of the National Weather Service in Pendleton. Flood forecasts on Mill Creek and the Walla Walla River are issued to civil defense and other authorities through the offices of the National Weather Service in Pendleton and Walla Walla, Washington.

3.0 ENGINEERING METHODS

For the flooding sources studied in detail in the community, standard hydrologic and hydraulic study methods were used to determine the flood hazard data required for this study. Flood events of a magnitude which are expected to be equaled or exceeded once on the average during any 10-, 50-, 100-, or 500-year period (recurrence interval) have been selected as having special significance for flood plain management and for flood insurance rates. These events, commonly termed the 10-, 50-, 100-, and 500-year floods, have a 10, 2, 1, and 0.2 percent chance, respectively, of being equaled or exceeded during any year. Although the recurrence interval represents the long-term average period between floods of a specific magnitude, rare floods could occur at short intervals or even within the same year. The risk of experiencing a rare flood increases when periods greater than 1 year are considered. For example, the risk of having a flood which equals or exceeds the 100-year flood (1 percent chance of annual exceedence) in any 50-year period is approximately 40 percent (4 in 10), and, for any 90-year period, the risk increases to approximately 60 percent (6 in 10). The analyses reported herein reflect flooding potentials based on conditions existing in the community at the time of completion of this study. Maps and flood elevations will be amended periodically to reflect future changes.

3.1 Hydrologic Analyses

Hydrologic analyses were carried out to establish the peak discharge-frequency relationships for each flooding source studied in detail affecting the community.

Several gaging stations in the Walla Walla and Umatilla River basins were the principal source of data for defining frequency-discharge

relationships for the streams studied in detail. The gaging station locations and periods of record are as follows:

Gaging Station	Period of Record
Umatilla River Near Umatilla	1904-1985
Umatilla River at Yoakum	1904-1985
Umatilla River at Pendleton	1904-5, 1922-1973
Umatilla River Above Meacham Creek	1933-1973
McKay Creek Near Pilot Rock	1921, 1927-1973
Birch Creek at Pilot Rock	1920-1973
Butter Creek Near Pine City	1929-1973
Wildhorse Creek Near Athena	1965, 1968-1973
Mill Creek Near Walla Walla	1914-17, 1940-1973
Mill Creek at Walla Walla	1941-1973
North Fork Walla Walla River Near Milton-Freewater	1969-1973
South Fork Walla Walla River Near Milton-Freewater	1903, 1906-1917, 1931-1985
Walla Walla River Near Touchet	1951-1973
Blue Creek Near Walla Walla	1939-1973

To define discharge-frequency data for Umatilla River, McKay Creek, Wildhorse Creek, Walla Walla River, South Fork Walla Walla River, and Mill Creek, which are gaged streams, and for Stage Gulch, Tutuilla Creek, and Patawa Creek, which are ungaged streams, a regional relationship between basin characteristics and streamflow statistics (Reference 1) was the principal method used. The regional relationship of peak discharge data and drainage-area parameters was analyzed. Frequency statistics in the form of logarithm mean flood, standard deviation, and skew for gaged areas were plotted versus drainage-area parameters, such as drainage-area size, normal annual precipitation, and basin mean elevation. The frequency statistics for the ungaged areas and areas remote from a gaging station were selected from the curves and applied using the log-Pearson Type III method (Reference 2). Values of the 10-, 50-, 100-, and 500-year peak discharges were obtained from the log-Pearson Type III distribution of annual peak-flow data (Reference 2).

To define the frequency-discharge data for Patawa Creek, the Snyder Unit Hydrograph method was used. Specific frequency precipitation was derived from the National Oceanic and Atmospheric Administration Atlas 2, "Precipitation-Frequency Atlas of the Western United States," Volume X-Oregon (Reference 3). The specific frequency precipitation was applied to the unit hydrograph which determined the specific frequency discharges. The frequency curve was derived by applying the log-Pearson Type III method to the specific frequency discharges.

Peak discharges for floods of selected recurrence intervals of Wildhorse, Tutuilla Mills and McKay Creeks; South Fork Walla Walla, Walla Walla, and Umatilla Rivers; and Waterman and Stage Gulches used in this analysis are shown in Table 1.

Table 1. Summary of Discharges

Flooding Source and Location	Drainage Area (Square Miles)	Peak Discharges (cfs) 10-Year	50-Year	100-Year	500-Year
Umatilla River					
At Umatilla, Oregon	2,290	10,800[1]	17,800[1]	21,600[1]	31,900[1]
At Confluence With Butter Creek	2,250	14,000	22,500	28,000	43,000
Stage Gulch					
At Confluence With Umatilla River	117	920	1,590	1,960	3,030
McKay					
At Confluence With Umatilla River	--[2]	1,030	2,600	4,000	13,000
Tutuilla Creek					
At Confluence With Umatilla River	--[2]	1,100	2,500	3,400	6,300
At Confluence With Patawa Creek	--[2]	600	1,370	1,860	3,420
Patawa Creek	38	1,000	1,800	2,200	3,500
Wildhorse Creek	--[2]	2,850	6,900	9,600	19,500
Waterman Gulch					
At Confluence With Wildhorse Creek	10.1	--[2]	--[2]	1,360	--[2]
Mill Creek	95	3,200	4,450	6,100	11,000
Walla Walla River	170	3,000	7,550	11,000	22,700
Near Touchet					

[1]Discharges for This Drainage Area Reflect a Reduction in Discharge by Temporary Valley Storage on the Umatilla River Below the Yoakum Gage

[2]Data Not Available

3.2 Hydraulic Analyses

Analyses of the hydraulic characteristics of flooding from the sources studied were carried out to provide estimates of the elevations of floods of the selected recurrence intervals.

Cross sections for streams were field surveyed, determined from detailed topographic maps (Reference 4), or obtained from aerial photography (References 5, 6, and 7). All bridges and culverts were surveyed to obtain elevation data and structural geometry.

Locations of selected cross sections used in the hydraulic analyses are shown on the Flood Profiles (Exhibit 1). For stream segments for which a floodway was computed (Section 4.2), selected cross section locations are also shown on the Flood Insurance Rate map (Exhibit 2).

Channel roughness factors (Manning's "n") used in the hydraulic computations were chosen by engineering judgment and based on field observations of the streams and flood plain areas. The roughness value for the main channel of the Patawa Creek is 0.040 with flood plain roughness values ranging from 0.050 to 0.070 for all floods. The roughness value for the main channel of the South Fork Walla Walla River is 0.055 with flood plain roughness value of 0.065 for all floods. Roughness values for the main channel of the Umatilla River range from 0.035 to 0.038 with flood plain roughness values ranging from 0.040 to 0.080 for all floods.

Roughness values for all other streams studied ranged from 0.035 to 0.400 for the main channels and 0.08 to 1.10 for the overbank areas.

The acceptability of all assumed hydraulic factors, cross sections, and hydraulic structure data was checked by computations that duplicated historical floodwater profiles.

Water-surface elevations of floods of the selected recurrence intervals were computed through use of the COE HEC-2 step-backwater computer program (Reference 8). Flood profiles were drawn showing computed water-surface elevations for floods of the selected recurrence intervals (Exhibit 1).

Only the 100-year water-surface elevation was computed for Waterman Gulch.

Starting water-surface elevations for Umatilla and South Fork Walla Walla Rivers and Waterman Gulch were calculated using the slope-area method. Starting water-surface elevations on Stage Gulch were taken from the Umatilla River. Starting water-surface elevations for Patawa Creek were taken from Tutuilla Creek.

The hydraulic analyses for this study were based on unobstructed flow. The flood elevations shown on the profiles are thus considered valid only if hydraulic structures remain unobstructed, operate properly, and do not fail.

All elevations are referenced to the National Geodetic Vertical Datum of 1929 (NGVD). Elevation reference marks used in this study are shown on the maps; the descriptions of the marks are presented in Elevation Reference Marks (Exhibit 3).

4.0 FLOOD PLAIN MANAGEMENT APPLICATIONS

The NFIP encourages State and local governments to adopt sound flood plain management programs. Therefore, each Flood Insurance Study provides 100-year flood elevations and delineations of the 100- and 500-year flood plain boundaries and 100-year floodway to assist communities in developing flood plain management measures.

4.1 Flood Boundaries

To provide a national standard without regional discrimination, the 1 percent annual chance (100-year) flood has been adopted by FEMA as the base flood for flood plain management purposes. The 0.2 percent annual chance (500-year) flood is employed to indicate additional areas of flood risk in the community. For each stream studied in detail, the 100- and 500-year flood plain boundaries have been delineated using the flood elevations determined at each cross section. Between cross sections, the boundaries were interpolated using aerial photographs at scales of 1:3,600, 1:4,800, 1:6,000, and 1:12,000 (Reference 5); orthophoto topographic maps at a scale of 1:2,400, with a contour interval of 2 feet (References 6 and 7); topographic maps at a scale of 1:1,200, with a contour interval of 2 feet (Reference 9); and by field inspection.

The 100- and 500-year flood plain boundaries are shown on the Flood Insurance Rate Map (Exhibit 2). On this map, the 100-year flood plain boundary corresponds to the boundary of the areas of special flood hazards (Zones A and AE), and the 500-year flood plain boundary corresponds to the boundary of areas of moderate flood hazards. In cases where the 100- and 500-year flood plain boundaries are close together, only the 100-year flood plain boundary has been shown. Small areas within the flood plain boundaries may lie above the flood elevations but cannot be shown due to limitations of the map scale and/or lack of detailed topographic data.

For the streams studied by approximate methods, only the 100-year flood plain boundary is shown on the Flood Insurance Rate Map (Exhibit 2). The 100-year flood plain boundaries were delineated using topographic maps at a scale of 1:24,000, with a contour interval of 10 feet (Reference 4), and aerial photographs at scales of 1:3,600, 1:4,800, 1:6,000, and 1:12,000 (Reference 5).

4.2 Floodways

Encroachment on flood plains, such as structures and fill, reduces flood-carrying capacity, increases flood heights and velocities, and increases flood hazards in areas beyond the encroachment itself. One aspect of flood plain management involves balancing the economic gain from flood plain development against the resulting increase in flood hazard. For purposes of the NFIP, a floodway is used as a tool to assist local communities in this aspect of flood plain management. Under this concept, the area of the 100-year flood plain is divided into a floodway and a floodway fringe. The floodway is the channel of a stream, plus any adjacent flood plain areas, that must be kept free of encroachment so that the 100-year flood can be carried without substantial increases in flood heights. Minimum Federal standards limit such increases to 1.0 foot, provided that hazardous velocities are not produced. The floodways in this study are presented to local agencies as minimum standards that can be adopted directly or that can be used as a basis for additional floodway studies.

The floodways presented in this study were computed for certain stream segments on the basis of equal conveyance reduction from each side of the flood plain. Floodway widths were computed at cross sections. Between cross sections, the floodway boundaries were interpolated. The results of the floodway computations are tabulated for selected cross sections (Table 2). The computed floodways are shown on the Flood Insurance Rate Map (Exhibit 2). In cases where the floodway and 100-year flood plain boundaries are either close together or collinear, only the floodway boundary is shown.

Data were not tabulated for the floodway on the Umatilla River in the Echo and Stanfield areas. This floodway was based on hydraulic computations, as were the others, but was adjusted using engineering judgment and negotiated with the community and FEMA.

The area between the floodway and 100-year flood plain boundaries is termed the floodway fringe. The floodway fringe encompasses the portion of the flood plain that could be completely obstructed without increasing the water-surface elevation of the 100-year flood by more than 1 foot at any point. Typical relationships between the floodway and the floodway fringe and their significance to flood plain development are shown in Figure 3.

FLOODING SOURCE		FLOODWAY			BASE FLOOD WATER SURFACE ELEVATION			
CROSS SECTION	DISTANCE[1]	WIDTH (FEET)	SECTION AREA (SQUARE FEET)	MEAN VELOCITY (FEET PER SECOND)	REGULATORY	WITHOUT FLOODWAY	WITH FLOODWAY	INCREASE
					(FEET NGVD)			
Umatilla River								
A	23,600	143	1,921	11.2	412.8	412.8	413.8	1.0
B	25,106	300	3,467	6.2	416.1	416.1	417.1	1.0
C	25,930	349	4,001	5.4	417.0	417.0	418.0	1.0
D	27,118	453/383[2]	4,413	4.9	417.9	417.9	418.9	1.0
E	28,382	762	5,117	4.2	418.9	418.9	419.8	0.9
F	29,735	210	2,427	8.9	419.8	419.8	420.6	0.8
G	31,922	151	1,987	10.9	424.2	424.2	424.7	0.5
H	33,739	822	3,370	6.4	428.2	428.2	429.1	0.9
I	34,863	353	2,783	7.8	430.1	430.1	431.0	0.9
J	36,468	256	2,541	8.5	433.4	433.4	433.9	0.5
K	37,395	219	2,091	10.3	435.3	435.3	435.9	0.6
L	40,017	873	3,726	5.8	442.0	442.0	442.3	0.3
M	44,065	328	2,809	7.7	447.3	447.3	448.1	0.8
N	44,950	153	2,764	7.8	448.4	448.4	449.2	0.8
O	46,909	229	2,291	9.4	454.5	454.5	455.5	1.0
P	49,334	471	2,135	10.1	466.3	466.3	466.3	0.0
Q	51,311	216	2,678	10.5	473.3	473.3	473.3	0.0
R	53,289	615	4,582	6.1	482.5	482.5	483.3	0.8
S	54,749	211	2,321	12.1	485.2	485.2	486.0	0.8
T	56,230	423	3,765	7.4	489.6	489.6	490.5	0.9
U	59,894	391	3,013	9.3	500.3	500.3	500.7	0.4
V	61,891	514	3,195	8.8	506.8	506.8	507.4	0.6
W	63,297	326	2,625	10.7	510.6	510.6	511.1	0.5
X	64,698	302	3,034	9.2	514.6	514.6	515.2	0.6
Y	66,361	184	2,863	9.8	516.9	516.9	517.8	0.9
Z	67,478	262	3,526	7.9	519.0	519.0	520.0	1.0

[1]Feet Above Confluence With Columbia River

[2]Width/Width Within Umatilla County

TABLE 2

FEDERAL EMERGENCY MANAGEMENT AGENCY

UMATILLA COUNTY, OR
(UNINCORPORATED AREAS)

FLOODWAY DATA

UMATILLA RIVER

FLOODING SOURCE		FLOODWAY			BASE FLOOD WATER SURFACE ELEVATION			
CROSS SECTION	DISTANCE[1]	WIDTH (FEET)	SECTION AREA (SQUARE FEET)	MEAN VELOCITY (FEET PER SECOND)	REGULATORY	WITHOUT FLOODWAY	WITH FLOODWAY	INCREASE
					(FEET NGVD)			
Umatilla River (Cont'd)								
AA	70,069	340	3,326	8.4	522.2	522.2	523.1	0.9
AB	71,473	468	3,900	7.2	526.7	526.7	527.1	0.4
AC	72,543	323	2,436	11.5	528.3	528.3	528.5	0.2
AD	74,421	43[illegible]	3,899	7.2	534.7	534.7	534.8	0.1
AE	76,581	453	3,414	8.2	538.2	538.2	538.4	0.2
AF	78,311	366	3,662	7.6	541.1	541.1	541.3	0.2
AG	79,955	629	5,576	5.0	543.3	543.3	543.9	0.6
AH	305,200	165	1,584	10.4	1,109.3	1,109.3	1,109.4	0.1
AI	305,970	161	1,260	13.1	1,112.5	1,112.5	1,112.7	0.2

[1]Feet Above Confluence With Columbia River

TABLE 2

FEDERAL EMERGENCY MANAGEMENT AGENCY

UMATILLA COUNTY, OR
(UNINCORPORATED AREAS)

FLOODWAY DATA

UMATILLA RIVER

FLOODING SOURCE		FLOODWAY			BASE FLOOD WATER SURFACE ELEVATION			
CROSS SECTION	DISTANCE[1]	WIDTH[2] (FEET)	SECTION AREA (SQUARE FEET)	MEAN VELOCITY (FEET PER SECOND)	REGULATORY	WITHOUT FLOODWAY	WITH FLOODWAY	INCREASE[3]
					(FEET NGVD)			
McKay Creek								
A	1,200	109/59[2]	679	5.9	1,000.2	1,000.2	1,001.2	1.0
B	1,930	456	800	5.0	1,003.8	1,003.8	1,003.8	0.0
C	2,800	222	586	6.8	1,008.2	1,008.2	1,008.2	0.0
D	3,620	117	439	9.1	1,014.4	1,014.4	1,014.4	0.0
E	4,460	103	422	9.5	1,021.4	1,021.4	1,021.7	0.3
F	5,450	139	608	6.6	1,028.5	1,028.5	1,029.0	0.5
G	6,730	844	1,266	3.2	1,032.5	1,032.5	1,033.2	0.7
H	7,460	85/60[2]	347	11.5	1,038.0	1,038.0	1,038.0	0.0
I	8,250	274	1,100	3.6	1,044.9	1,044.9	1,044.9	0.0
J	8,900	108/88[2]	429	9.3	1,045.7	1,045.7	1,046.2	0.5
K	12,500	123/23[2]	504	7.9	1,065.6	1,065.6	1,065.6	0.0
L	13,260	99	444	9.0	1,071.0	1,071.0	1,071.4	0.4
M	14,400	98	581	6.9	1,077.6	1,077.6	1,077.7	0.1
N	15,190	83	369	10.8	1,081.3	1,081.3	1,081.5	0.2
O	15,890	98	511	7.8	1,086.5	1,086.5	1,087.2	0.7
P	16,660	486	1,498	2.7	1,091.3	1,091.3	1,091.6	0.3
Q	17,630	118	379	10.6	1,095.0	1,095.0	1,095.8	0.8
R	18,880	359	510	7.8	1,106.2	1,106.2	1,106.6	0.4
S	19,790	135	675	5.9	1,110.1	1,110.1	1,110.5	0.4
T	20,880	176	522	7.7	1,115.1	1,115.1	1,115.1	0.0
U	22,550	249	1,021	3.9	1,126.7	1,126.7	1,126.7	0.0
V	23,960	362	526	7.6	1,130.1	1,130.1	1,130.2	0.1
W	27,400	97	527	7.6	1,146.4	1,146.4	1,146.9	0.5
X	29,840	59	335	11.9	1,159.9	1,159.9	1,160.5	0.6
Y	30,070	54	398	10.1	1,163.2	1,163.2	1,163.2	0.0
Z	30,510	68	611	6.5	1,165.3	1,165.3	1,165.3	0.0

[1]Feet Above Mouth [2]Width/Width Within Umatilla County

TABLE 2

FEDERAL EMERGENCY MANAGEMENT AGENCY

UMATILLA COUNTY, OR
(UNINCORPORATED AREAS)

FLOODWAY DATA

MCKAY CREEK

FLOODING SOURCE		FLOODWAY			BASE FLOOD WATER SURFACE ELEVATION			
CROSS SECTION	DISTANCE[1]	WIDTH (FEET)	SECTION AREA (SQUARE FEET)	MEAN VELOCITY (FEET PER SECOND)	REGULATORY	WITHOUT FLOODWAY	WITH FLOODWAY	INCREASE
					(FEET NGVD)			
McKay Creek (Cont'd)								
AA	30,950	350	1,217	3.1	1,170.5	1,170.5	1,171.5	1.0
AB	31,750	157	1,000	4.0	1,172.0	1,172.0	1,172.3	0.3

[1]Feet Above Mouth

TABLE 2

FEDERAL EMERGENCY MANAGEMENT AGENCY

UMATILLA COUNTY, OR
(UNINCORPORATED AREAS)

FLOODWAY DATA

MCKAY CREEK

FLOODING SOURCE		FLOODWAY			BASE FLOOD WATER SURFACE ELEVATION			
CROSS SECTION	DISTANCE[1]	WIDTH (FEET)	SECTION AREA (SQUARE FEET)	MEAN VELOCITY (FEET PER SECOND)	REGULATORY	WITHOUT FLOODWAY	WITH FLOODWAY	INCREASE
					(FEET NGVD)			
Tutuilla Creek								
A	200	76	663	5.1	1,027.0	1,027.0	1,028.0	1.0
B	1,430	56	271	12.5	1,031.9	1,031.9	1,031.9	0.0
C	11,955	150	471	3.9	1,111.7	1,111.7	1,112.0	0.3
D	12,200	160	344	5.4	1,112.5	1,112.5	1,112.6	0.1

[1]Feet Above Confluence With Umatilla River

TABLE 2

FEDERAL EMERGENCY MANAGEMENT AGENCY

UMATILLA COUNTY, OR
(UNINCORPORATED AREAS)

FLOODWAY DATA

TUTUILLA CREEK

BLANK PAGE

FLOODING SOURCE		FLOODWAY			BASE FLOOD WATER SURFACE ELEVATION			
CROSS SECTION	DISTANCE[1]	WIDTH (FEET)	SECTION AREA (SQUARE FEET)	MEAN VELOCITY (FEET PER SECOND)	REGULATORY	WITHOUT FLOODWAY	WITH FLOODWAY	INCREASE
					(FEET NGVD)			
Patawa Creek								
A	2,898	37	181	12.1	1,109.4	1,109.4	1,109.4	0.0
B	3,888	202	475	8.1	1,120.8	1,120.8	1,121.1	0.3
C	4,888	50	268	8.9	1,126.7	1,126.7	1,126.8	0.1
D	5,730	56	226	11.5	1,136.1	1,136.1	1,136.3	0.2
E	6,433	171	526	6.0	1,142.3	1,142.3	1,143.0	0.7
F	7,123	219	383	9.8	1,148.9	1,148.9	1,149.2	0.3
G	7,936	47	256	8.6	1,154.7	1,154.7	1,155.0	0.3
H	8,543	231	440	9.5	1,161.4	1,161.4	1,161.5	0.1

[1]Feet above confluence with Tutuilla Creek

TABLE 2

FEDERAL EMERGENCY MANAGEMENT AGENCY

UMATILLA COUNTY, OR
(UNINCORPORATED AREAS)

FLOODWAY DATA

PATAWA CREEK

FLOODING SOURCE		FLOODWAY			BASE FLOOD WATER SURFACE ELEVATION			
CROSS SECTION	DISTANCE[1]	WIDTH (FEET)	SECTION AREA (SQUARE FEET)	MEAN VELOCITY (FEET PER SECOND)	REGULATORY	WITHOUT FLOODWAY	WITH FLOODWAY	INCREASE
					(FEET NGVD)			
Wildhorse Creek								
A	155	225	1,309	7.3	1,095.9	1,095.9	1,096.5	0.6
B	625	450	1,903	5.0	1,098.7	1,098.7	1,098.8	0.1
C	1,100	120	847	11.3	1,099.9	1,099.9	1,100.7	0.8
D	2,100	74	814	11.8	1,110.9	1,110.9	1,111.2	0.3
E	2,750	56	582	16.5	1,114.1	1,114.1	1,114.1	0.0
F	3,380	87	962	10.0	1,119.2	1,119.2	1,119.7	0.5
G	3,855	69	650	14.8	1,120.5	1,120.5	1,121.1	0.6
H	4,650	197	1,304	7.4	1,126.6	1,126.6	1,127.5	0.9
I	5,050	237	936	10.3	1,128.8	1,128.8	1,128.8	0.0
J	5,290	90	683	14.1	1,132.7	1,132.7	1,132.7	0.0
K[2]	5,980	120	1,011	9.5	1,136.5	1,136.5	1,136.5	0.0
L[2]	6,600	200	1,111	8.6	1,138.3	1,138.3	1,139.0	0.7
M[2]	7,290	170	1,300	7.4	1,142.5	1,142.5	1,142.5	0.0
N[2]	7,950	63	561	17.1	1,143.6	1,143.6	1,143.6	0.0
O[2]	8,610	215	1,245	7.7	1,148.8	1,148.8	1,149.7	0.9
P[2]	9,285	190	1,101	8.7	1,152.1	1,152.1	1,152.7	0.6
Q	9,970	287	1,634	5.9	1,155.1	1,155.1	1,155.5	0.4
R	10,765	223	933	10.3	1,159.6	1,159.6	1,159.6	0.0
S	10,880	82	730	13.2	1,161.2	1,161.2	1,161.2	0.0
T	11,060	159	977	9.8	1,162.0	1,162.0	1,162.5	0.5
U	11,170	165	1,106	8.7	1,163.5	1,163.5	1,163.5	0.0
V	11,800	165	848	11.3	1,166.6	1,166.6	1,166.6	0.0
W	12,500	138	839	11.4	1,169.9	1,169.9	1,170.8	0.9
X	13,125	89	816	11.8	1,174.1	1,174.1	1,174.8	0.7
Y	13,800	82	853	11.3	1,177.7	1,177.7	1,178.0	0.3
Z	14,530	202	1,217	7.9	1,180.9	1,180.9	1,181.5	0.6

[1]Feet Above Mouth [2]Cross Section Entirely Within Umatilla Indian Reservation

TABLE 2

FEDERAL EMERGENCY MANAGEMENT AGENCY

UMATILLA COUNTY, OR
(UNINCORPORATED AREAS)

FLOODWAY DATA

WILDHORSE CREEK

FLOODING SOURCE		FLOODWAY			BASE FLOOD WATER SURFACE ELEVATION			
CROSS SECTION	DISTANCE[1]	WIDTH (FEET)	SECTION AREA (SQUARE FEET)	MEAN VELOCITY (FEET PER SECOND)	REGULATORY	WITHOUT FLOODWAY	WITH FLOODWAY	INCREASE
					(FEET NGVD)			
Wildhorse Creek (Cont'd)								
AA	15,150	239	1,155	8.3	1,184.5	1,184.5	1,184.7	0.2
AB	15,755	169	1,122	8.6	1,187.4	1,187.4	1,188.1	0.7
AC	16,465	193	1,513	6.3	1,191.0	1,191.0	1,192.0	1.0
AD	17,120	128	670	14.3	1,194.6	1,194.6	1,194.6	0.0
AE	17,755	500	1,546	6.2	1,199.9	1,199.9	1,200.4	0.5
AF	18,325	88	856	11.2	1,202.5	1,202.5	1,202.5	0.0

[1]Feet Above Mouth

TABLE 2

FEDERAL EMERGENCY MANAGEMENT AGENCY

UMATILLA COUNTY, OR
(UNINCORPORATED AREAS)

FLOODWAY DATA

WILDHORSE CREEK

FLOODING SOURCE		FLOODWAY			BASE FLOOD WATER SURFACE ELEVATION			
CROSS SECTION	DISTANCE[1]	WIDTH (FEET)	SECTION AREA (SQUARE FEET)	MEAN VELOCITY (FEET PER SECOND)	REGULATORY	WITHOUT FLOODWAY	WITH FLOODWAY	INCREASE
					(FEET NGVD)			
Waterman Gulch								
A	5,045	95	247	5.5	1,737.2	1,737.2	1,738.2	1.0
B	5,505	150	235	5.8	1,740.6	1,740.6	1,741.0	0.4

[1]Feet Above Mouth

TABLE 2

FEDERAL EMERGENCY MANAGEMENT AGENCY

UMATILLA COUNTY, OR
(UNINCORPORATED AREAS)

FLOODWAY DATA

WATERMAN GULCH

FLOODING SOURCE		FLOODWAY			BASE FLOOD WATER SURFACE ELEVATION			
CROSS SECTION	DISTANCE[1]	WIDTH (FEET)	SECTION AREA (SQUARE FEET)	MEAN VELOCITY (FEET PER SECOND)	REGULATORY	WITHOUT FLOODWAY (FEET NGVD)	WITH FLOODWAY (FEET NGVD)	INCREASE
Walla Walla River								
A	211,000	169[2]	1,037	10.6	777.0	777.0	778.0	1.0
B	211,800	277	1,377	8.0	783.6	783.6	783.8	0.2
C	212,900	498	2,420	4.6	789.0	789.0	789.9	0.9
D	214,250	584	1,597	6.9	797.6	797.6	797.6	0.0
E	215,350	344	1,492	7.4	804.3	804.3	804.9	0.6
F	216,125	322	1,427	7.7	808.6	808.6	809.4	0.8
G	217,125	199	901	12.2	820.1	820.1	820.6	0.5
H	218,100	336	1,693	6.5	827.7	827.7	828.4	0.7
I	220,250	255	1,239	8.9	845.1	845.1	845.9	0.8
J	220,900	156	834	13.2	852.6	852.6	852.6	0.0
K	249,550	849	1,251	6.0	1,186.9	1,186.9	1,186.9	0.0
L	250,170	841	1,557	4.8	1,193.3	1,193.3	1,194.0	0.7
M	251,150	386	1,162	6.5	1,206.8	1,206.8	1,207.5	0.7
N	252,100	159	699	10.7	1,217.3	1,217.3	1,217.9	0.6
O	253,025	128	766	9.9	1,225.2	1,225.2	1,226.0	0.8
P	253,525	219	713	10.5	1,234.2	1,234.2	1,234.2	0.0
Q	254,350	179	819	9.2	1,241.7	1,241.7	1,242.3	0.6
R	255,350	219	810	9.3	1,255.7	1,255.7	1,256.4	0.7
S	255,780	458	1,316	5.7	1,263.1	1,263.1	1,263.8	0.7
T	256,200	117	588	12.8	1,269.2	1,269.2	1,269.2	0.0
U	256,475	102	559	13.4	1,273.5	1,273.5	1,273.5	0.0
V	256,525	147	1,081	6.9	1,276.6	1,276.6	1,276.6	0.0
W	257,755	79	514	14.6	1,290.0	1,290.0	1,290.0	0.0
X	258,250	80	635	11.8	1,295.3	1,295.3	1,295.9	0.6
Y	258,800	81	518	14.5	1,302.1	1,302.1	1,302.1	0.0
Z	259,550	258	1,038	7.2	1,310.9	1,310.9	1,311.2	0.3

[1]Feet Above Mouth [2]Floodway Lies Outside County Limits

TABLE 2

FEDERAL EMERGENCY MANAGEMENT AGENCY

UMATILLA COUNTY, OR
(UNINCORPORATED AREAS)

FLOODWAY DATA

WALLA WALLA RIVER

FLOODING SOURCE		FLOODWAY			BASE FLOOD WATER SURFACE ELEVATION			
CROSS SECTION	DISTANCE[1]	WIDTH (FEET)	SECTION AREA (SQUARE FEET)	MEAN VELOCITY (FEET PER SECOND)	REGULATORY	WITHOUT FLOODWAY	WITH FLOODWAY	INCREASE
					(FEET NGVD)			
Walla Walla River (Cont'd)								
AA	259,950	108	566	13.2	1,314.5	1,314.5	1,314.5	0.0
AB	260,700	211	1,029	7.3	1,322.7	1,322.7	1,322.7	0.0
AC	261,405	273	769	9.8	1,330.0	1,330.0	1,330.0	0.0
AD	262,150	240	851	8.8	1,340.7	1,340.7	1,340.7	0.0
AE	263,505	287	917	8.2	1,358.7	1,358.7	1,359.0	0.3
AF	263,805	288	971	7.7	1,362.9	1,362.9	1,363.8	0.9

[1]Feet Above Mouth

TABLE 2

FEDERAL EMERGENCY MANAGEMENT AGENCY

UMATILLA COUNTY, OR
(UNINCORPORATED AREAS)

FLOODWAY DATA

WALLA WALLA RIVER

FLOODING SOURCE		FLOODWAY			BASE FLOOD WATER SURFACE ELEVATION			
CROSS SECTION	DISTANCE[1]	WIDTH (FEET)	SECTION AREA (SQUARE FEET)	MEAN VELOCITY (FEET PER SECOND)	REGULATORY	WITHOUT FLOODWAY	WITH FLOODWAY	INCREASE
					(FEET NGVD)			
South Fork Walla Walla River								
A	0	82	408	7.9	1,920.8	1,920.8	1,921.8	1.0
B	720	103	397	8.1	1,931.3	1,931.3	1,931.3	0.0
C	1,190	83	341	9.4	1,939.2	1,939.2	1,939.4	0.2
D	1,768	73	426	7.6	1,946.6	1,946.6	1,946.8	0.2
E	2,307	49	273	11.8	1,955.5	1,955.5	1,955.5	0.0
F	2,793	101	410	7.8	1,966.3	1,966.3	1,966.6	0.3
G	3,133	145	456	7.1	1,971.7	1,971.7	1,971.7	0.0
H	4,054	65	324	10.0	1,988.7	1,988.7	1,988.8	0.1
I	4,396	78	313	10.3	1,995.8	1,995.8	1,995.8	0.0
J	4,819	113	481	6.7	2,001.5	2,001.5	2,002.4	0.9

[1]Feet Above Limit of Detailed Study

TABLE 2

FEDERAL EMERGENCY MANAGEMENT AGENCY

UMATILLA COUNTY, OR
(UNINCORPORATED AREAS)

FLOODWAY DATA

SOUTH FORK WALLA WALLA RIVER

FLOODING SOURCE		FLOODWAY			BASE FLOOD WATER SURFACE ELEVATION			
CROSS SECTION	DISTANCE[1]	WIDTH (FEET)	SECTION AREA (SQUARE FEET)	MEAN VELOCITY (FEET PER SECOND)	REGULATORY	WITHOUT FLOODWAY	WITH FLOODWAY	INCREASE
					(FEET NGVD)			
Mill Creek								
A	117,000	95[2]	538	9.4	2,063.2	2,063.2	2,064.2	1.0
B	117,250	162	462	10.9	2,067.2	2,067.2	2,067.2	0.0
C	117,520	133	518	9.7	2,072.3	2,072.3	2,072.3	0.0
D	117,930	67	376	13.4	2,079.0	2,079.0	2,079.0	0.0
E	118,340	77	391	12.9	2,086.3	2,086.3	2,086.3	0.0
F	118,650	81	399	12.7	2,091.5	2,091.5	2,091.5	0.0
G	118,920	55	351	14.4	2,095.4	2,095.4	2,095.9	0.5
H	119,280	82	448	11.3	2,102.8	2,102.8	2,103.6	0.8
I	119,350	295	3,046	1.7	2,110.9	2,110.9	2,110.9	0.0
J	119,760	135	557	9.1	2,111.7	2,111.7	2,112.5	0.8
K	120,190	108	459	11.0	2,118.1	2,118.1	2,118.9	0.8
L	120,690	104	432	11.7	2,126.2	2,126.2	2,126.5	0.3
M	121,100	248	699	7.2	2,133.5	2,133.5	2,133.8	0.3
N	121,220	336	1,298	3.9	2,136.1	2,136.1	2,136.1	0.0
O	121,620	160	557	9.1	2,141.6	2,141.6	2,142.4	0.8
P	122,020	135	542	9.3	2,148.3	2,148.3	2,148.3	0.0
Q	122,450	156	519	9.7	2,156.0	2,156.0	2,156.3	0.3
R	122,840	427	949	5.3	2,160.2	2,160.2	2,161.1	0.9
S	123,280	130	432	11.7	2,168.2	2,168.2	2,168.2	0.0
T	123,740	143	591	8.5	2,173.4	2,173.4	2,173.9	0.5
U	123,980	150	490	10.3	2,178.9	2,178.9	2,178.9	0.0
V	124,240	210	734	6.9	2,182.5	2,182.5	2,182.5	0.0
W	124,520	208	526	9.6	2,186.6	2,186.6	2,186.6	0.0
X	124,790	461	1,030	4.9	2,191.5	2,191.5	2,191.5	0.0
Y	124,930	274	571	8.8	2,193.0	2,193.0	2,193.0	0.0
Z	125,290	40	315	16.0	2,200.0	2,200.0	2,200.8	0.8
AA	125,370	81	968	5.1	2,207.0	2,207.0	2,207.0	0.0

[1]Feet Above Mouth [2]Floodway Lies Outside County Limits

TABLE 2

FEDERAL EMERGENCY MANAGEMENT AGENCY

UMATILLA COUNTY, OR
(UNINCORPORATED AREAS)

FLOODWAY DATA

MILL CREEK

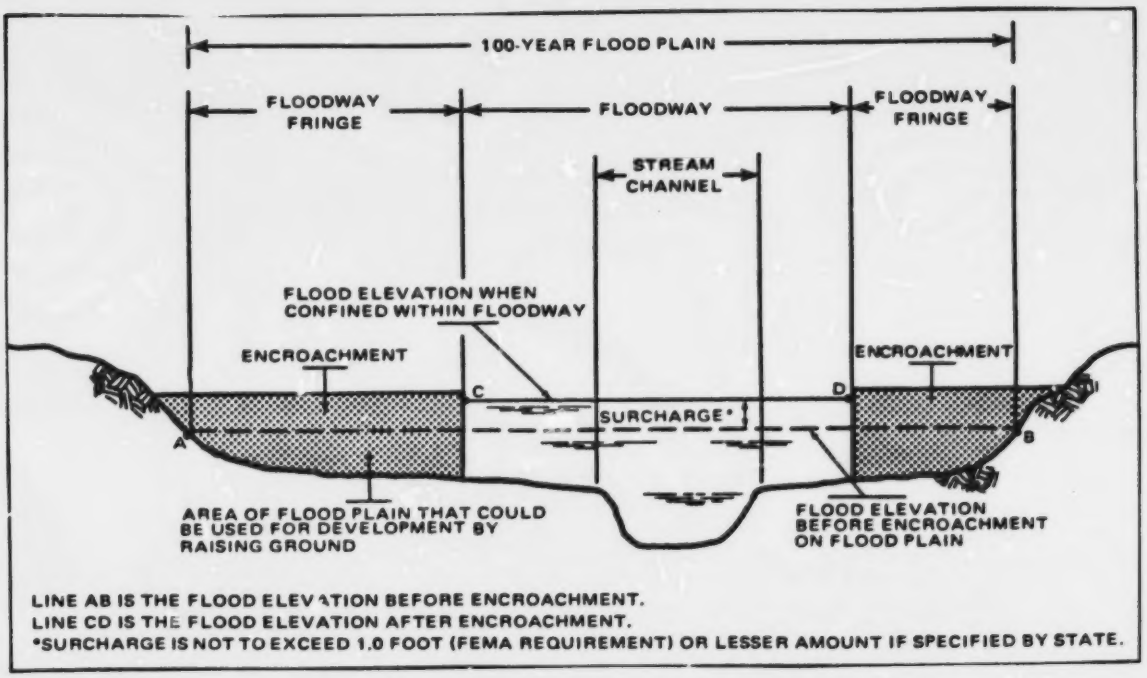
100-YEAR FLOOD PLAIN
FLOODWAY FRINGE
FLOODWAY
FLOODWAY FRINGE
STREAM CHANNEL
FLOOD ELEVATION WHEN CONFINED WITHIN FLOODWAY
ENCROACHMENT
ENCROACHMENT
C
D
SURCHARGE*
A
B
AREA OF FLOOD PLAIN THAT COULD BE USED FOR DEVELOPMENT BY RAISING GROUND
FLOOD ELEVATION BEFORE ENCROACHMENT ON FLOOD PLAIN
LINE AB IS THE FLOOD ELEVATION BEFORE ENCROACHMENT.
LINE CD IS THE FLOOD ELEVATION AFTER ENCROACHMENT.
*SURCHARGE IS NOT TO EXCEED 1.0 FOOT (FEMA REQUIREMENT) OR LESSER AMOUNT IF SPECIFIED BY STATE.

Figure 3. Floodway Schematic

5.0 INSURANCE APPLICATION

For flood insurance rating purposes, flood insurance zone designations are assigned to a community based on the results of the engineering analyses. These zones are as follows:

Zone A

Zone A is the flood insurance rate zone that corresponds to the 100-year flood plains that are determined in the Flood Insurance Study by approximate methods. Because detailed hydraulic analyses are not performed for such areas, no base flood elevations or depths are shown this zone.

Zone AE

Zone AE is the flood insurance rate zone that corresponds to the 100-year flood plains that are determined in the Flood Insurance Study by detailed methods. Whole-foot base flood elevations derived from the detailed hydraulic analyses are shown at selected intervals within this zone.

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Zone X

Zone X is the flood insurance rate zone that corresponds to areas outside the 500-year flood plain, areas within the 500-year flood plain, areas of 100-year flooding where average depths are less than 1 foot, areas of 100-year flooding where the contributing drainage area is less than 1 square mile, and areas protected from the 100-year flood by levees. No base flood elevations or depths are shown within this zone.

Zone D

Zone D is the flood insurance rate zone that corresponds to unstudied areas where flood hazards are undetermined, but possible.

6.0 FLOOD INSURANCE RATE MAP

The Flood Insurance Rate Map is designed for flood insurance and flood plain management applications.

For flood insurance applications, the map designates flood insurance rate zones as described in Section 5.0 and, in the 100-year flood plains that were studied by detailed methods, shows selected whole-foot base flood elevations or average depths. Insurance agents use the zones and base flood elevations in conjunction with information on structures and their contents to assign premium rates for flood insurance policies.

For flood plain management applications, the map shows by tints, screens, and symbols, the 100- and 500-year flood plains, the floodways, and the locations of selected cross sections used in the hydraulic analyses and floodway computations.

7.0 OTHER STUDIES

This Flood Insurance Study supersedes the previously published Flood Insurance Study for Umatilla County (Reference 10).

Flood Insurance Studies have been prepared for the Cities of Umatilla, Hermiston, Stanfield, Adams, Athena, Echo, Pendleton, and Ukiah, and for Union and Grant Counties, Oregon (References 11 through 20, respectively). These studies are in general agreement with this Flood Insurance Study.

A Flood Hazard Boundary Map has been prepared for the Cities of Pilot Rock and Weston, and for Wallowa County, Oregon (References 21, 22, and 23, respectively). These studies are in general agreement with this Flood Insurance Study.

Six Flood Plain Information reports have been prepared by the COE, Walla Walla District, for Umatilla County. These include reports on the Umatilla River, Echo-Stanfield, Oregon, and vicinity (Reference 24); Umatilla River, Mission-Riverside area (Reference 25); Umatilla River, Cayuse-Gibbon, Oregon (Reference 26); Umatilla River Tributaries, McKay, Tutuilla, and Wildhorse Creeks, Pendleton, Oregon, and vicinity (Reference 27); Walla Walla River, vicinity of Milton-Freewater, Oregon (Reference 28); Mill Creek, Walla Walla County, Washington, Kooskooskie and vicinity (Reference 29); and Mill Creek, Umatilla County, Oregon (Reference 30). The base flood flood elevations, flood profiles, and boundaries used in this study are basically the same as shown in these reports.

8.0 LOCATION OF DATA

Information concerning the pertinent data used in the preparation of this study can be obtained by contacting the Natural and Technological Hazards Division, FEMA, Federal Regional Center, 130 228th Street, SW., Bothell, Washington 98021-9796.

9.0 BIBLIOGRAPHY AND REFERENCES

1. U.S. Department of the Army, Corps of Engineers, Statistical Methods in Hydrology, Sacramento, California, January 1962

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3. U.S. Department of Commerce, National Oceanic and Atmospheric Administration, National Weather Service, Precipitation-Frequency Atlas of the Western United States, Volume X-Oregon, J.F. Miller, R.H. Frederick, and R.J. Tracey, 1973

4. U.S. Department of the Interior, Geological Survey, 7.5-Minute Series Topographic Maps, Scale 1:24,000, Contour Interval 10 feet: Adams, Oregon (1966); Athena, Oregon (1964); Barnhart, Oregon (1966); Hermiston, Oregon (1962), Photorevised (1970); McKay Reservoir (1966); Nolin, Oregon (1968); Pendleton, Oregon (1966); Pilot Rock, Oregon (1967); Stanfield, Oregon (1962); Table Rock, Oregon (1966); Ukiah, Oregon (1967); Umatilla, Oregon (1962), Photorevised (1970)

5. U.S. Department of the Army, Corps of Engineers, Walla Walla District, Aerial Photographs, Umatilla County, Oregon; Scales 1:3,600, 1:4,800, 1:6,000, and 1:12,000; May 1970, June 1971, June 1972, May 1973, and August 1974

6. U.S. Department of the Army, Corps of Engineers, Walla Walla District, Aerial Photographs, Umatilla River, Patawa Creek and South Fork Walla Walla River, Umatilla County, Oregon, Scale: 1:2,400, Contour Interval 5 feet, March 22, 1984

7. U.S. Department of the Army, Corps of Engineers, Portland District, Aerial Photography, Scale 1:2,400, Contour Interval 2 feet: Stanfield, Oregon (1981)

8. U.S. Department of the Army, Corps of Engineers, Hydrologic Engineering Center, HEC-2 Water-Surface Profiles, Generalized Computer Program, Davis, California, February 1972 and April 1980

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10. U.S. Department of Housing and Urban Development, Federal Insurance Administration, Flood Insurance Study, Umatilla County, Oregon, (Unincorporated Areas), December 1977

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12. Federal Emergency Management Agency, Flood Insurance Study, City of Hermiston, Oregon, unpublished

13. Federal Emergency Management Agency, Flood Insurance Study, City of Stanfield, Oregon, unpublished

14. Federal Emergency Management Agency, Flood Insurance Study, City of Adams, Oregon, 1984

15. Federal Emergency Management Agency, Flood Insurance Study, City of Athena, Oregon, 1984

16. Federal Emergency Management Agency, Flood Insurance Study, City of Echo, Oregon, 1984

17. Federal Emergency Management Agency, Flood Insurance Study, City of Pendleton, Oregon, unpublished

18. Federal Emergency Management Agency, Flood Insurance Study, City of Ukiah, Oregon, 1984

19. Federal Emergency Management Agency, Flood Insurance Study, Union County, Oregon (Unincorporated Areas), 1980

20. Federal Emergency Management Agency, Flood Insurance Study, Grant County, Oregon (Unincorporated Areas), 1982

21. U.S. Department of Housing and Urban Development, Flood Hazard Boundary Map, City of Pilot Rock, Oregon, Scale 1:9,600, December 1975

22. Federal Emergency Management Agency, Flood Hazard Boundary Map, City of Weston, Oregon, Scale 1:9,600, July 1981

23. U.S. Department of Housing and Urban Development, Flood Hazard Boundary Map, Wallowa County, Oregon (Unincorporated Areas), Scale 1:24,000, June 1977

24. U.S. Department of the Army, Corps of Engineers, Walla Walla District, Flood Plain Information, Umatilla River, Echo-Stanfield, Oregon and Vicinity, June 1974

25. U.S. Department of the Army, Corps of Engineers, Walla Walla District, Flood Plain Information, Umatilla River, Mission-Riverside Area Near Pendleton, Oregon, November 1969

26. U.S. Department of the Army, Corps of Engineers, Walla Walla District, Flood Plain Information, Umatilla River, Cayuse-Gibbon, Oregon, July 1975

27. U.S. Department of the Army, Corps of Engineers, Walla Walla District, Flood Plain Information, Umatilla River Tributaries, McKay, Tutuilla, and Wildhorse Creeks, Pendleton, Oregon and Vicinity, March 1971

28. U.S. Department of the Army, Corps of Engineers, Walla Walla District, Flood Plain Information, Walla Walla River, Vicinity of Milton-Freewater, Oregon, August 1974

29. U.S. Department of the Army, Corps of Engineers, Walla Walla District, Flood Plain Information, Mill Creek, Walla Walla County, Washington, Kooskooskie and Vicinity, May 1972

30. U.S. Department of the Army, Corps of Engineers, Walla Walla District, Special Flood Hazard Information Report, Mill Creek, Umatilla County, Oregon, February 1972

10.0 REVISIONS DESCRIPTIONS

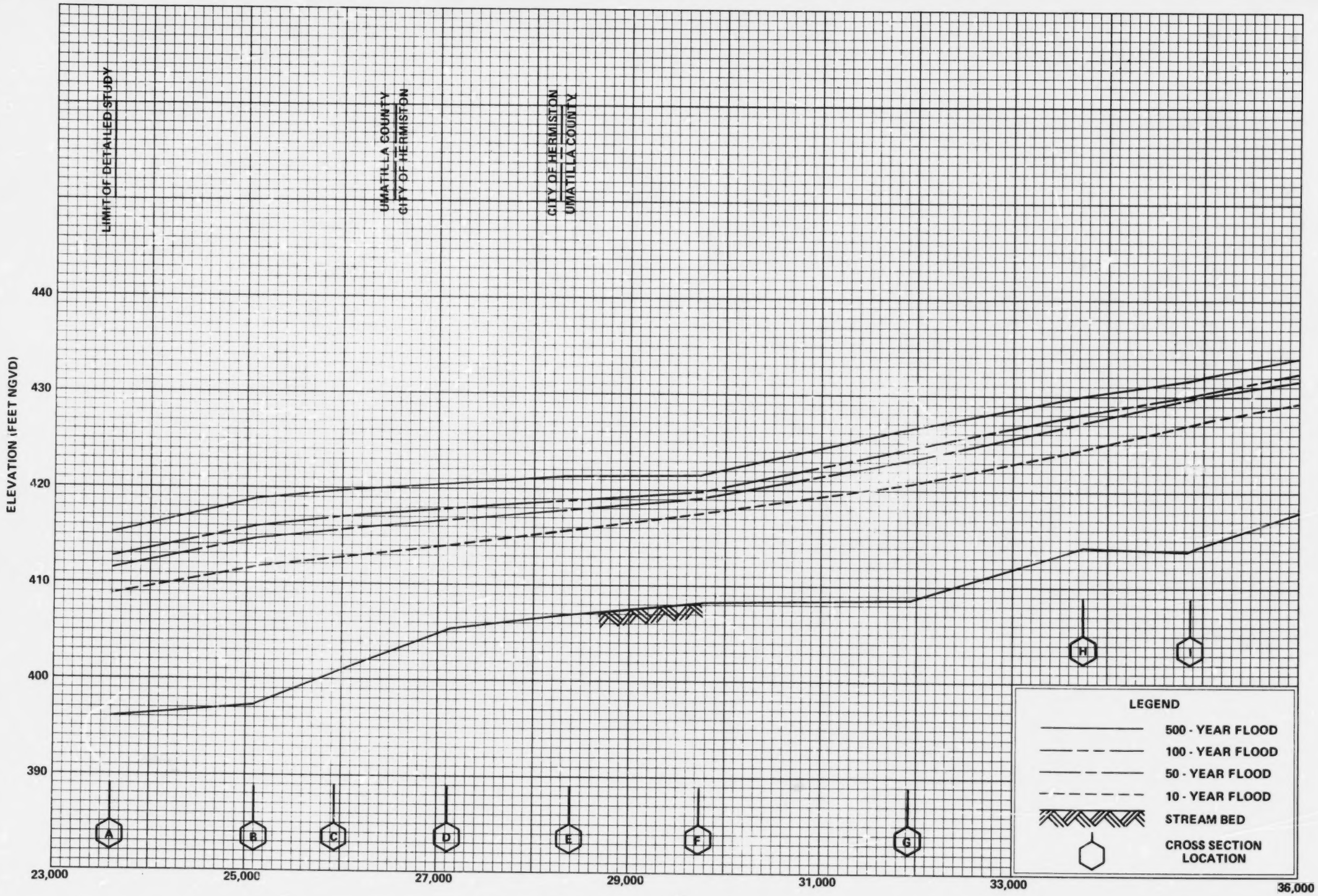
This section has been added to provide information regarding significant revisions made since the original Flood Insurance Study was printed. Future revisions may be made that do not result in the republishing of the Flood Insurance Study report. To assure that any user is aware of all revisions, it is advisable to contact the community repository of flood hazard data located at the Umatilla County Planning Department, 216 S.E. 4th, Pendleton, Oregon 97801.

10.1 First Revision

This study was revised on July 4, 1988 to incorporate the effects of a new hydrologic analysis of Patawa Creek on the Base Flood Elevations (BFEs) and flood boundaries. This revised hydrologic analysis was based on a study by the Oregon State Department of Transportation, Highways Division, which utilized regression equations developed in U.S. Geological Survey Report 82-4078, entitled Magnitude and Frequency of Floods in Eastern Oregon, and from the Oregon State Highways Division Hydraulics Manual. The result of this analysis was an increase to the discharges and BFEs along Patawa Creek, and a change in the flood boundaries. The Summary of Discharges Table, Floodway Data Table, and profiles have been revised to reflect the effects of these higher discharges.

Territory previously shown within the jurisdiction of Umatilla County has been modified to reflect recent annexations by the City of Pendleton.

A revision to the Flood Insurance Study for the City of Pendleton, Oregon is currently being prepared and is in complete agreement with this study.



FLOOD PROFILES

UMATILLA RIVER

FEDERAL EMERGENCY MANAGEMENT AGENCY

UMATILLA COUNTY, OR
(UNINCORPORATED AREAS)

01P

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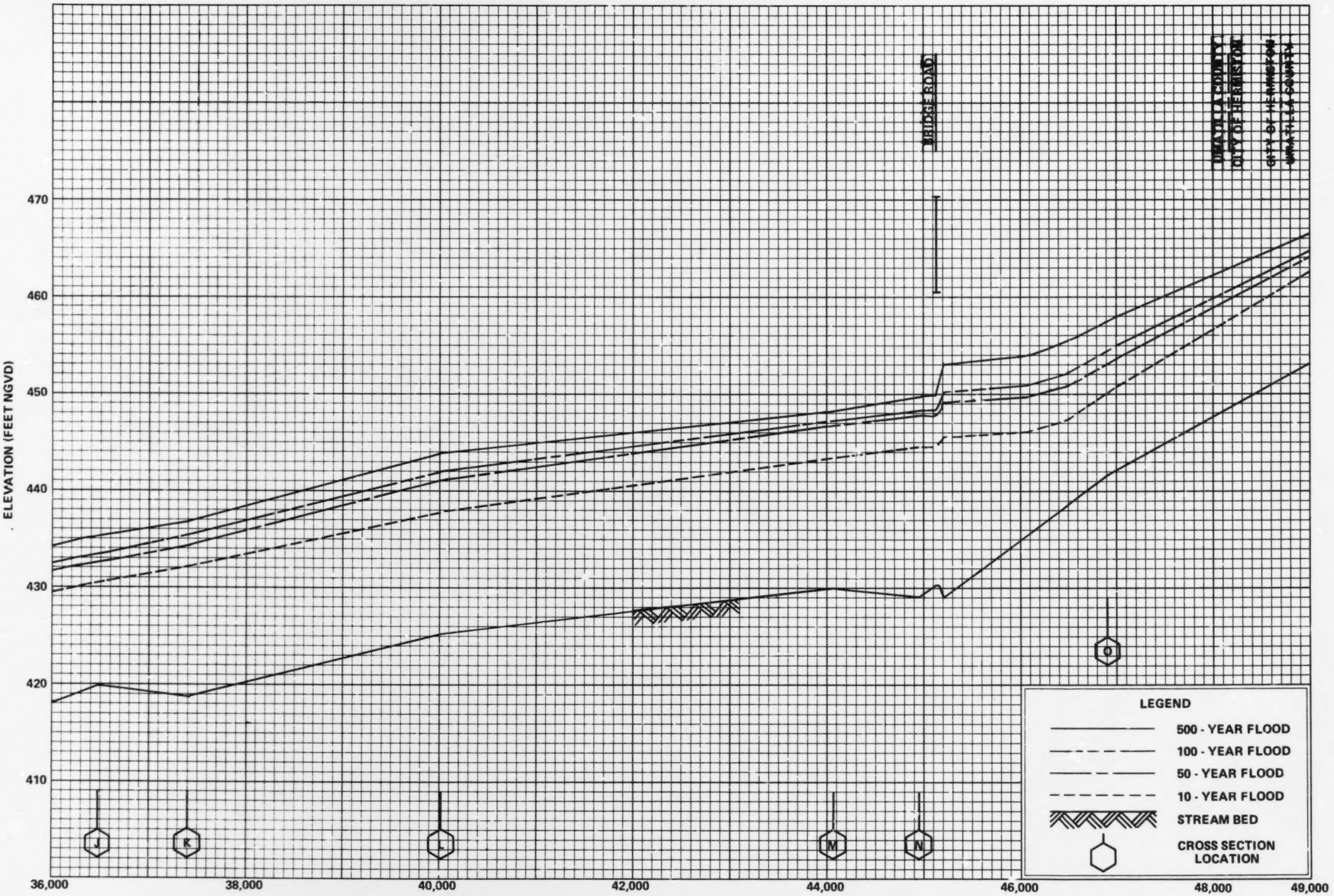

FLOOD PROFILES

UMATILLA RIVER

FEDERAL EMERGENCY MANAGEMENT AGENCY

UMATILLA COUNTY, OR
(UNINCORPORATED AREAS)

02P

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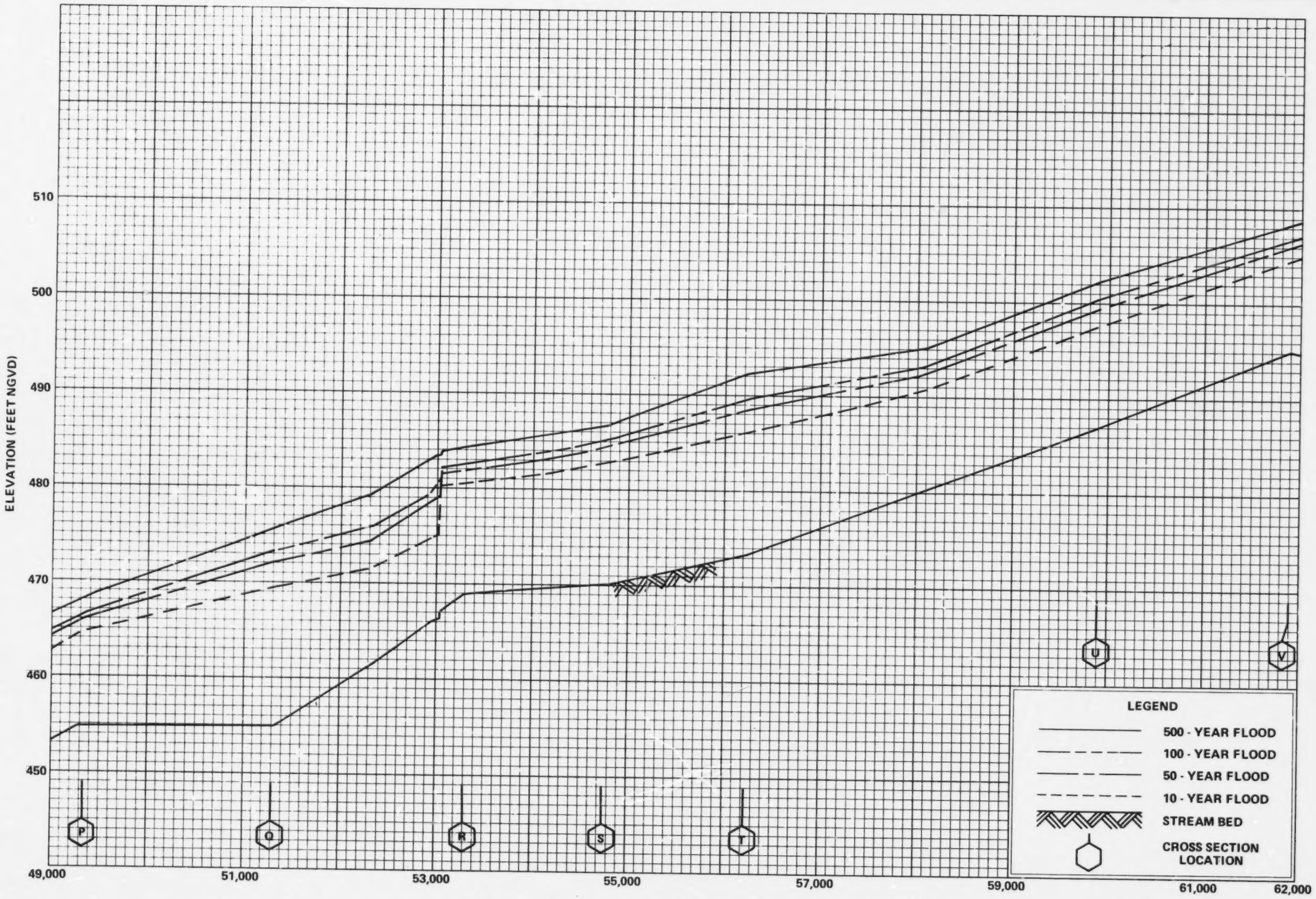

FLOOD PROFILES

UMATILLA RIVER

FEDERAL EMERGENCY MANAGEMENT AGENCY

UMATILLA COUNTY, OR
(UNINCORPORATED AREAS)

03P

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ELEVATION (FEET NGVD)

490 500 510 520 530 540 550

62,000 64,000 66,000 68,000 70,000 72,000 74,000 75,000

STREAM DISTANCE IN FEET ABOVE CONFLUENCE WITH COLUMBIA RIVER

W X Y Z AA AB AC AD

CONFLUENCE WITH LINE CANAL

UNION PACIFIC RAILROAD

LEGEND

500 - YEAR FLOOD

100 - YEAR FLOOD

50 - YEAR FLOOD

10 - YEAR FLOOD

STREAM BED

CROSS SECTION LOCATION

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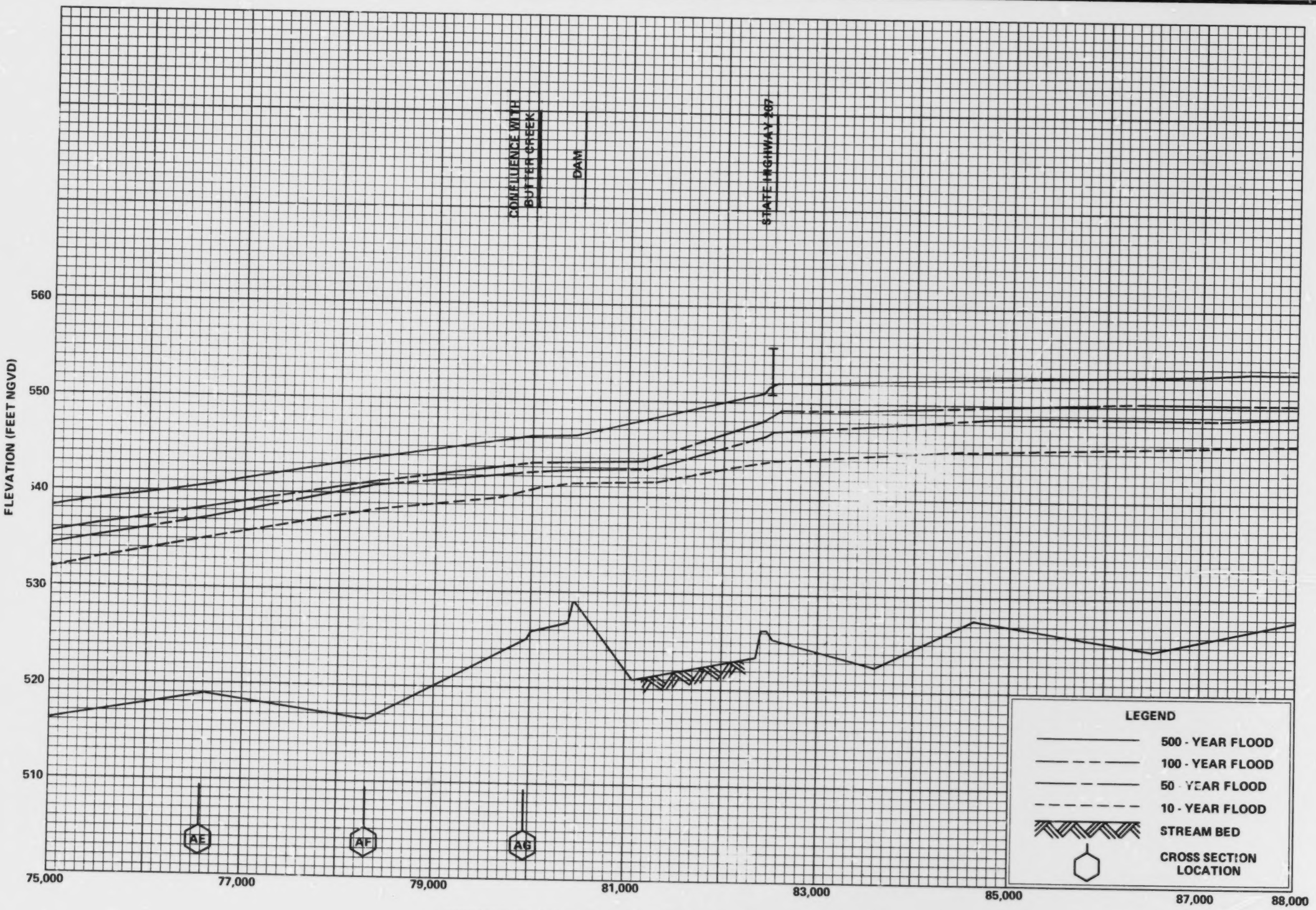
04P

FEDERAL EMERGENCY MANAGEMENT AGENCY

UMATILLA COUNTY, OR
(UNINCORPORATED AREAS)

FLOOD PROFILES

UMATILLA RIVER



ELEVATION (FEET NGVD)

STREAM DISTANCE IN FEET ABOVE CONFLUENCE WITH COLUMBIA RIVER

FLOOD PROFILES

UMATILLA RIVER

FEDERAL EMERGENCY MANAGEMENT AGENCY

UMATILLA COUNTY, OR
(UNINCORPORATED AREAS)

05P

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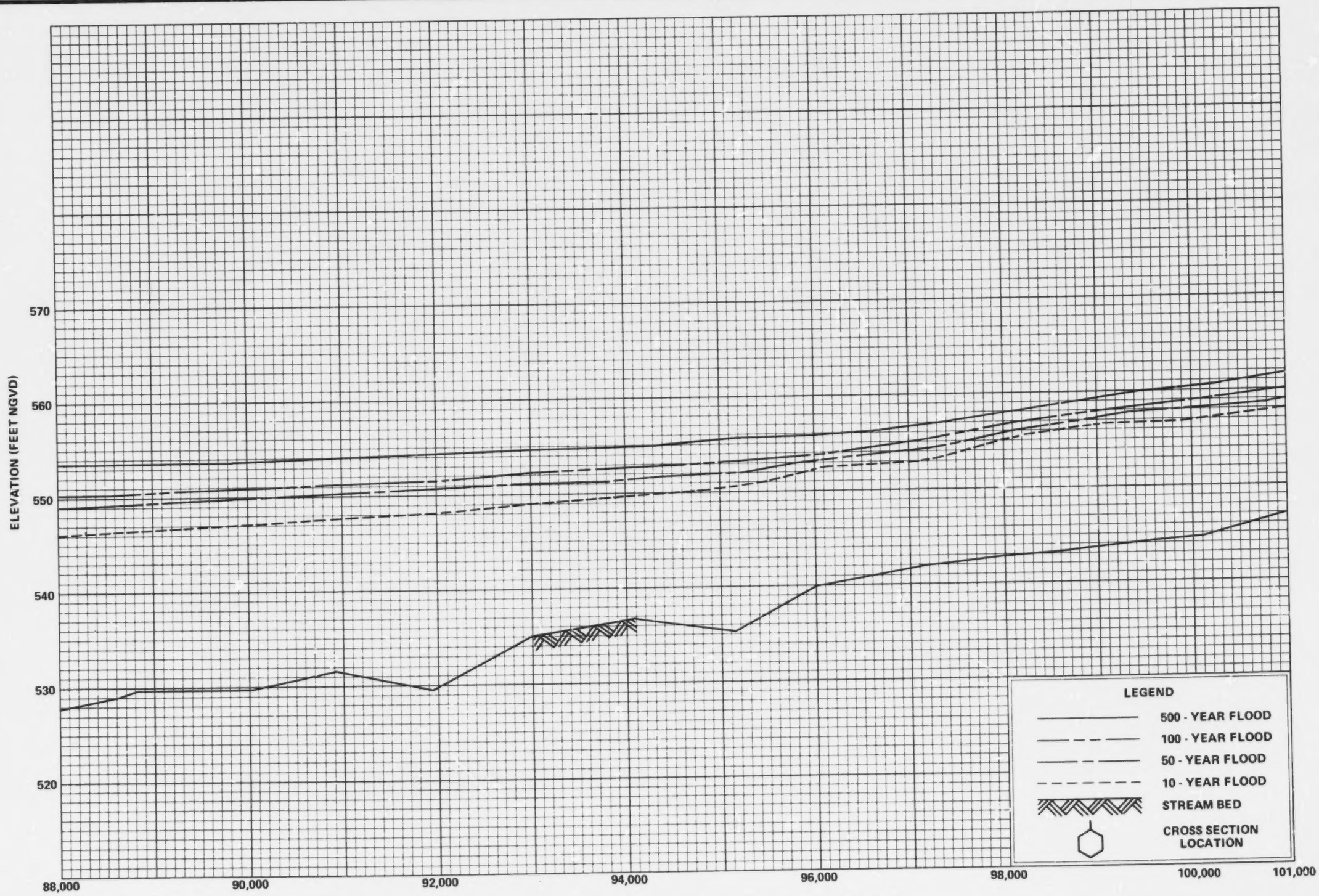

FLOOD PROFILES

UMATILLA RIVER

FEDERAL EMERGENCY MANAGEMENT AGENCY

UMATILLA COUNTY, OR
(UNINCORPORATED AREAS)

06P

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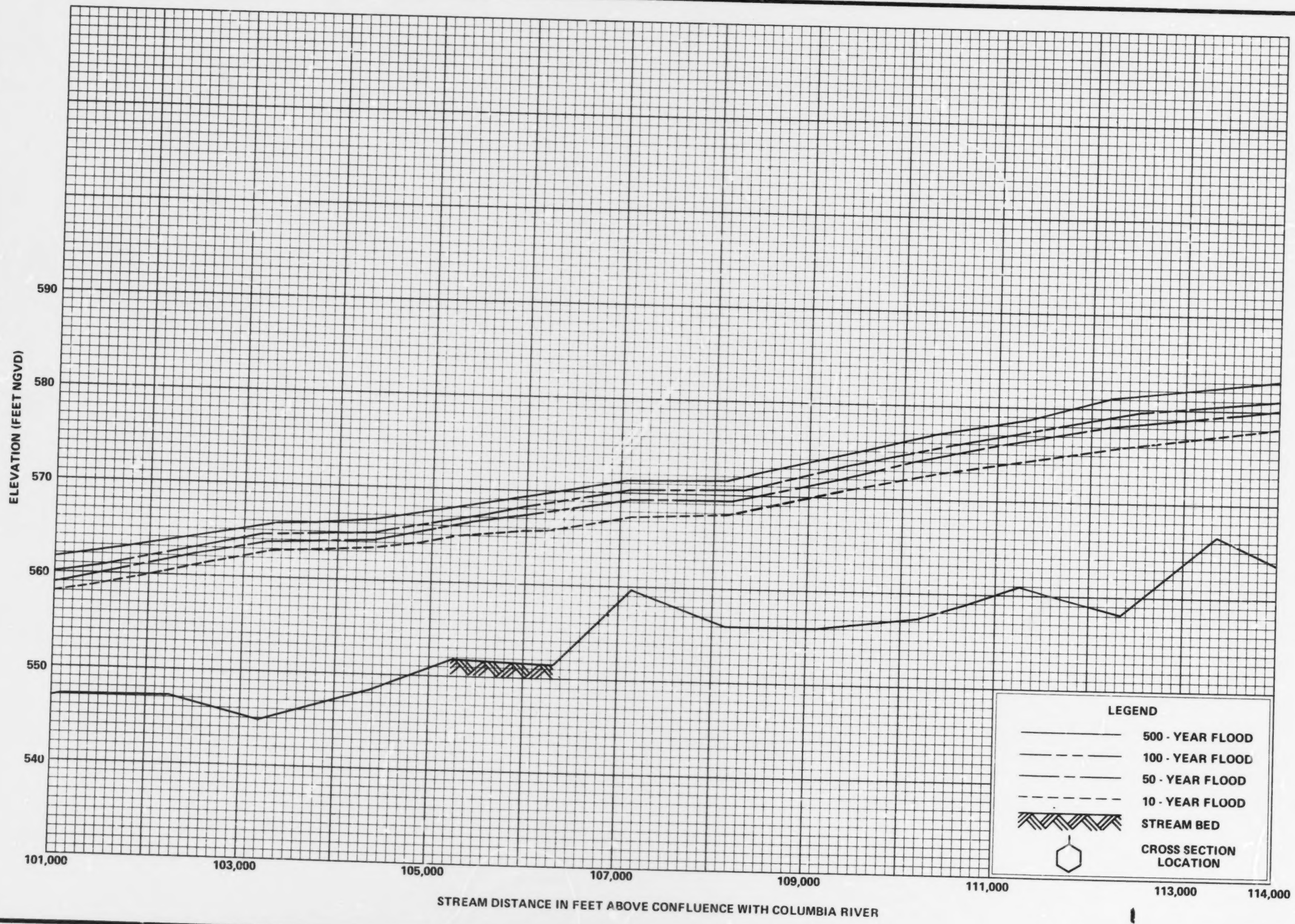

FLOOD PROFILES

UMATILLA RIVER

FEDERAL EMERGENCY MANAGEMENT AGENCY

UMATILLA COUNTY, OR
(UNINCORPORATED AREAS)

07P

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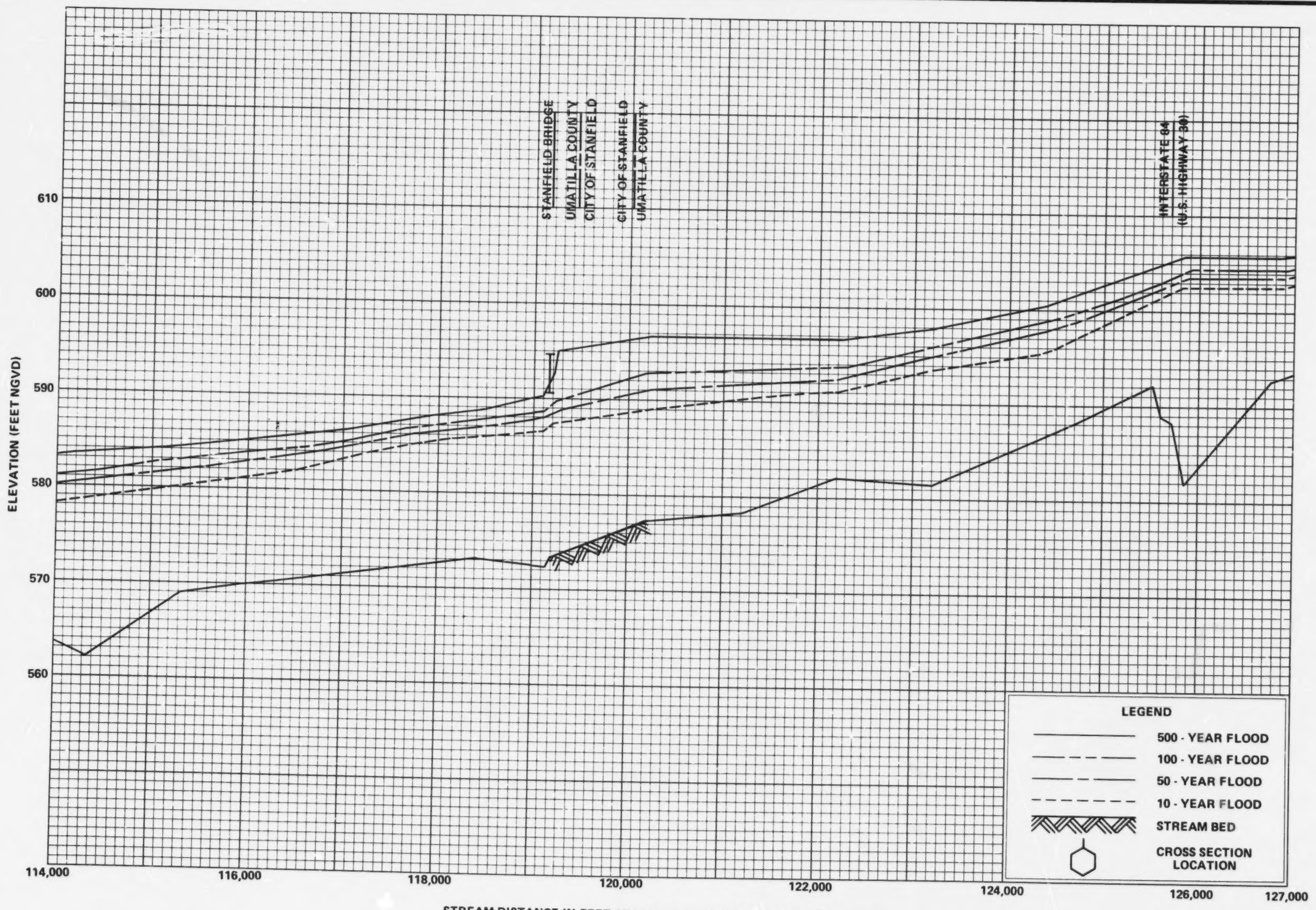

FLOOD PROFILES

UMATILLA RIVER

FEDERAL EMERGENCY MANAGEMENT AGENCY

UMATILLA COUNTY, OR
(UNINCORPORATED AREAS)

08P

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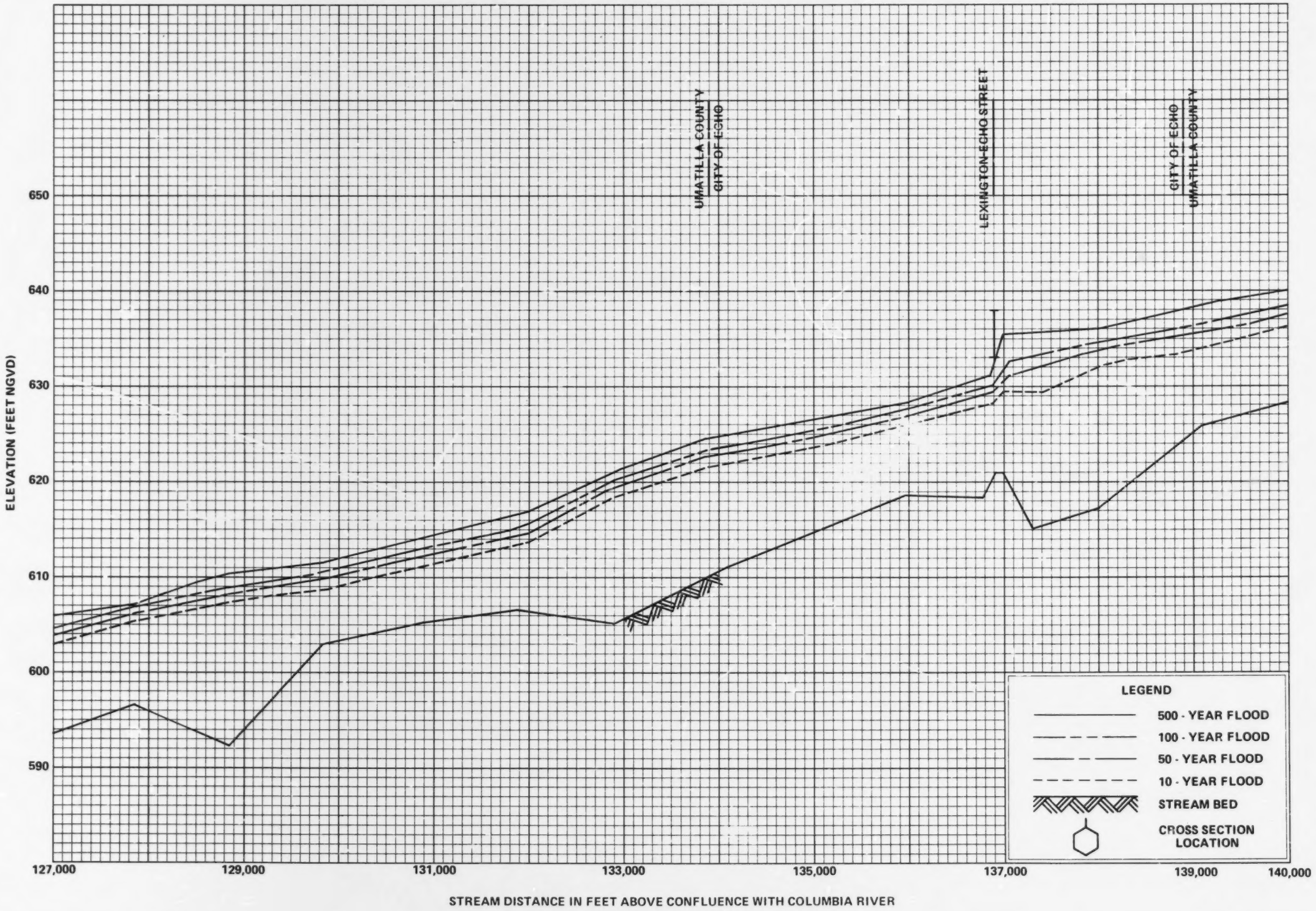

FLOOD PROFILES

UMATILLA RIVER

FEDERAL EMERGENCY MANAGEMENT AGENCY

UMATILLA COUNTY, OR
(UNINCORPORATED AREAS)

09P

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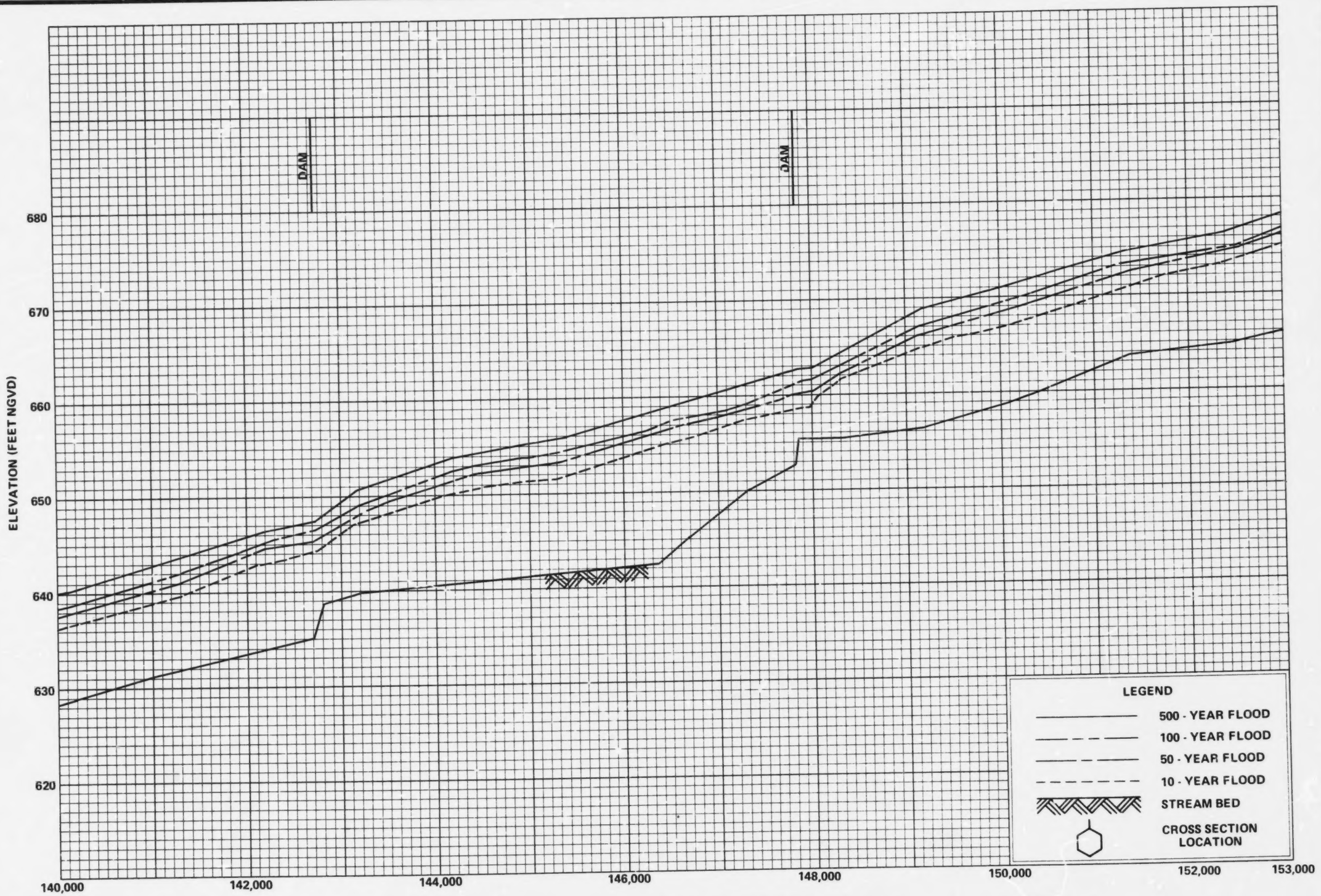

FLOOD PROFILES

UMATILLA RIVER

FEDERAL EMERGENCY MANAGEMENT AGENCY

UMATILLA COUNTY, OR
(UNINCORPORATED AREAS)

10P

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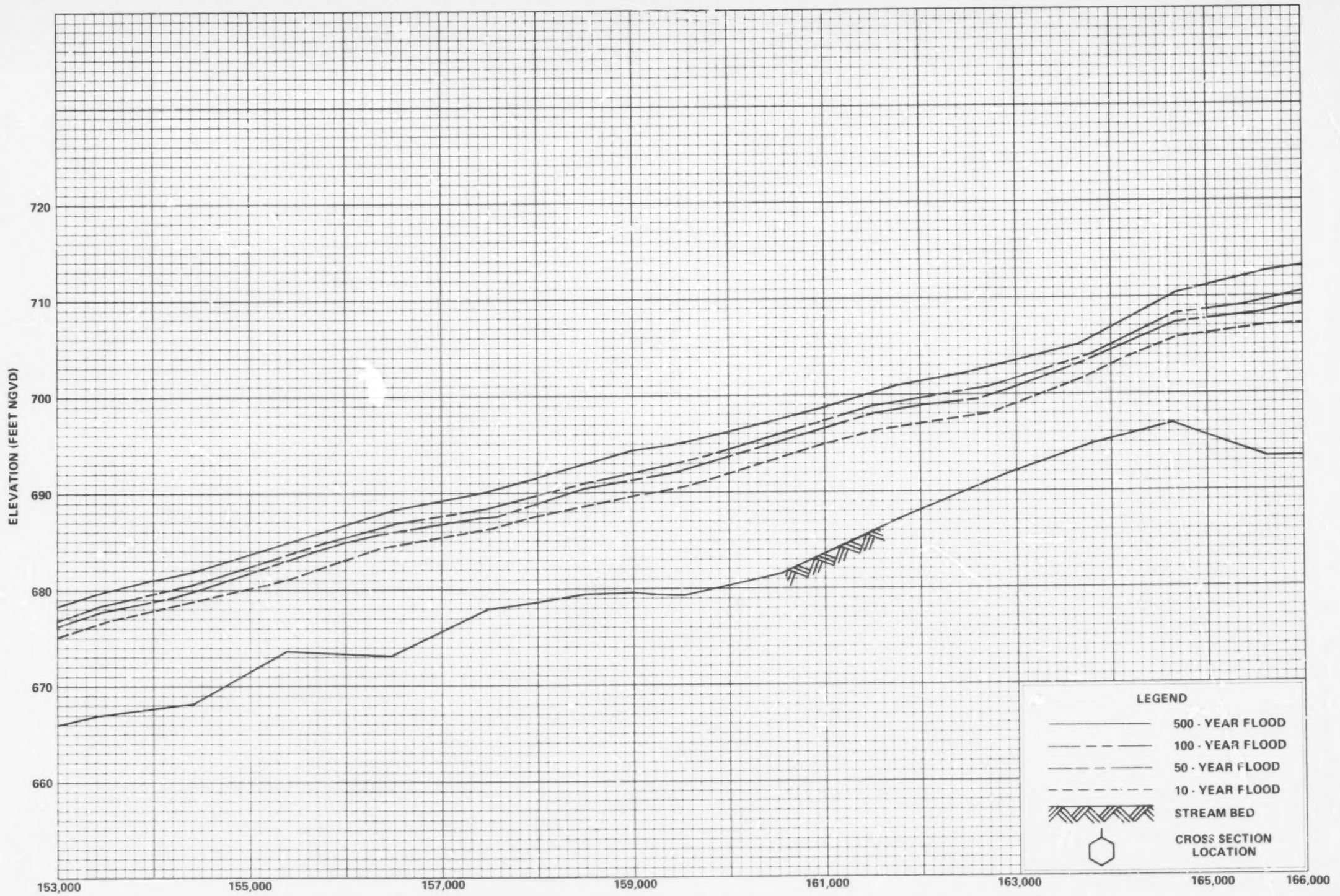

FLOOD PROFILES

UMATILLA RIVER

FEDERAL EMERGENCY MANAGEMENT AGENCY

UMATILLA COUNTY, OR
(UNINCORPORATED AREAS)

11P

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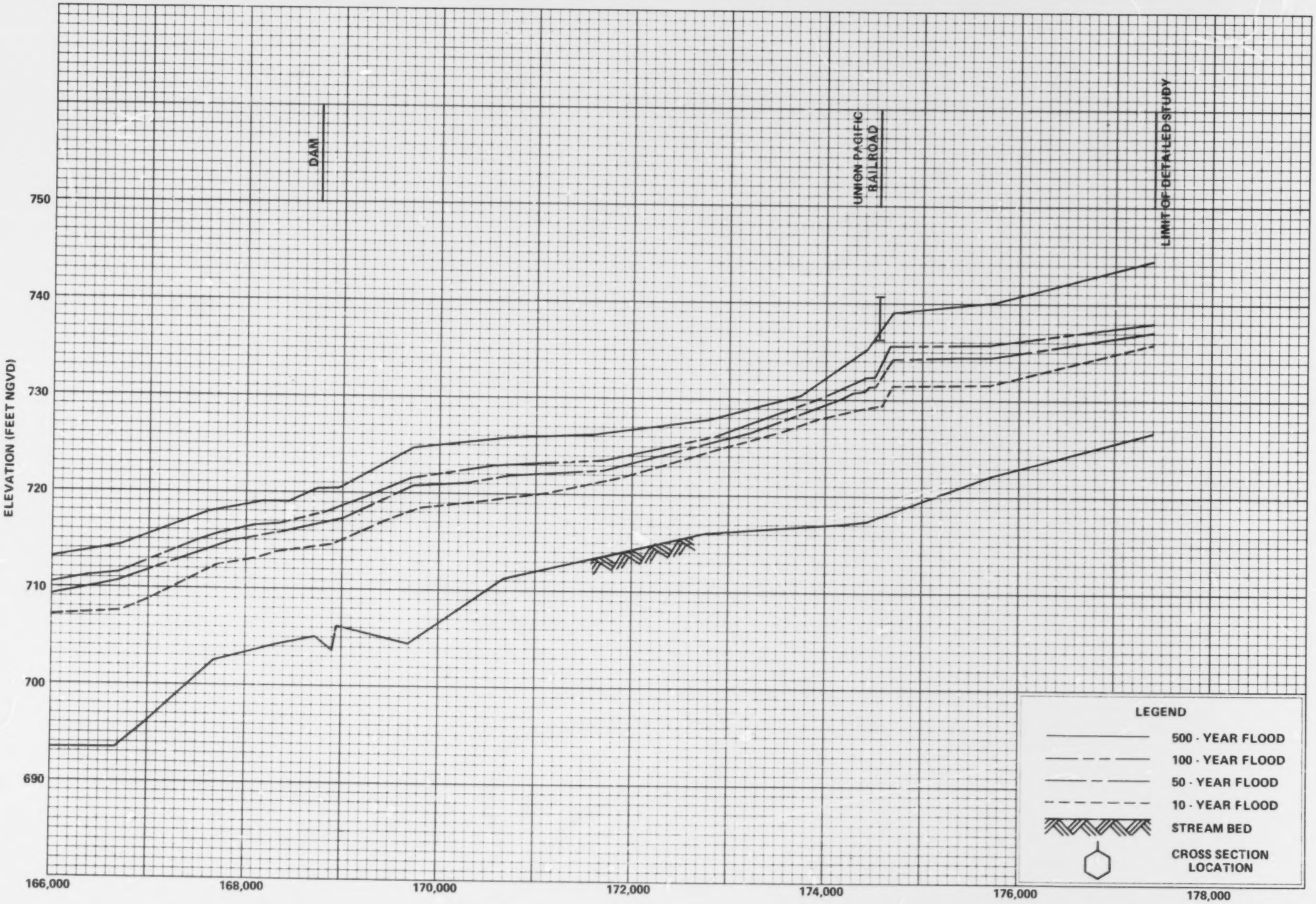

FLOOD PROFILES

UMATILLA RIVER

FEDERAL EMERGENCY MANAGEMENT AGENCY

UMATILLA COUNTY, OR
(UNINCORPORATED AREAS)

12P

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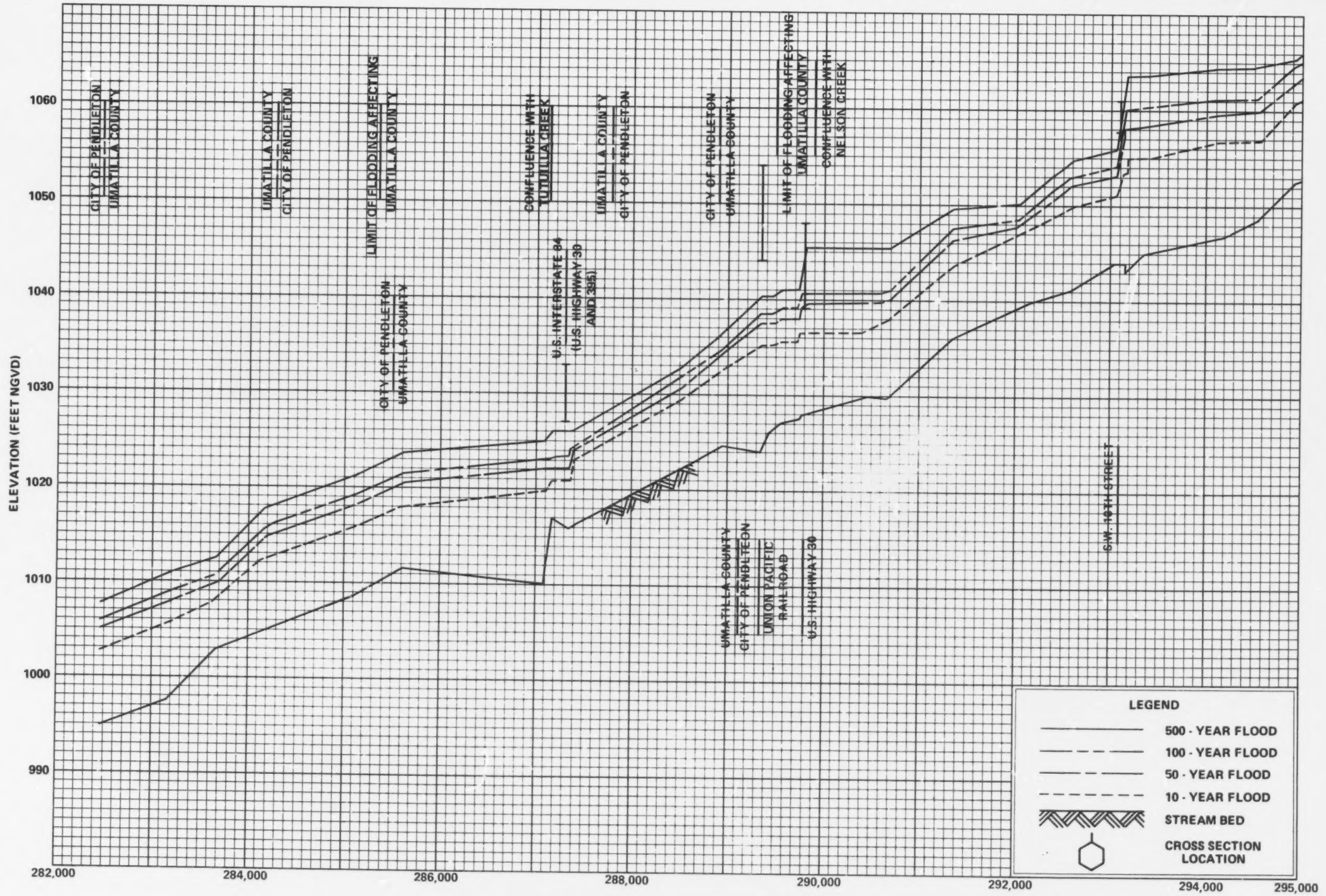

FLOOD PROFILES

UMATILLA RIVER

FEDERAL EMERGENCY MANAGEMENT AGENCY

UMATILLA COUNTY, OR
(UNINCORPORATED AREAS)

13P

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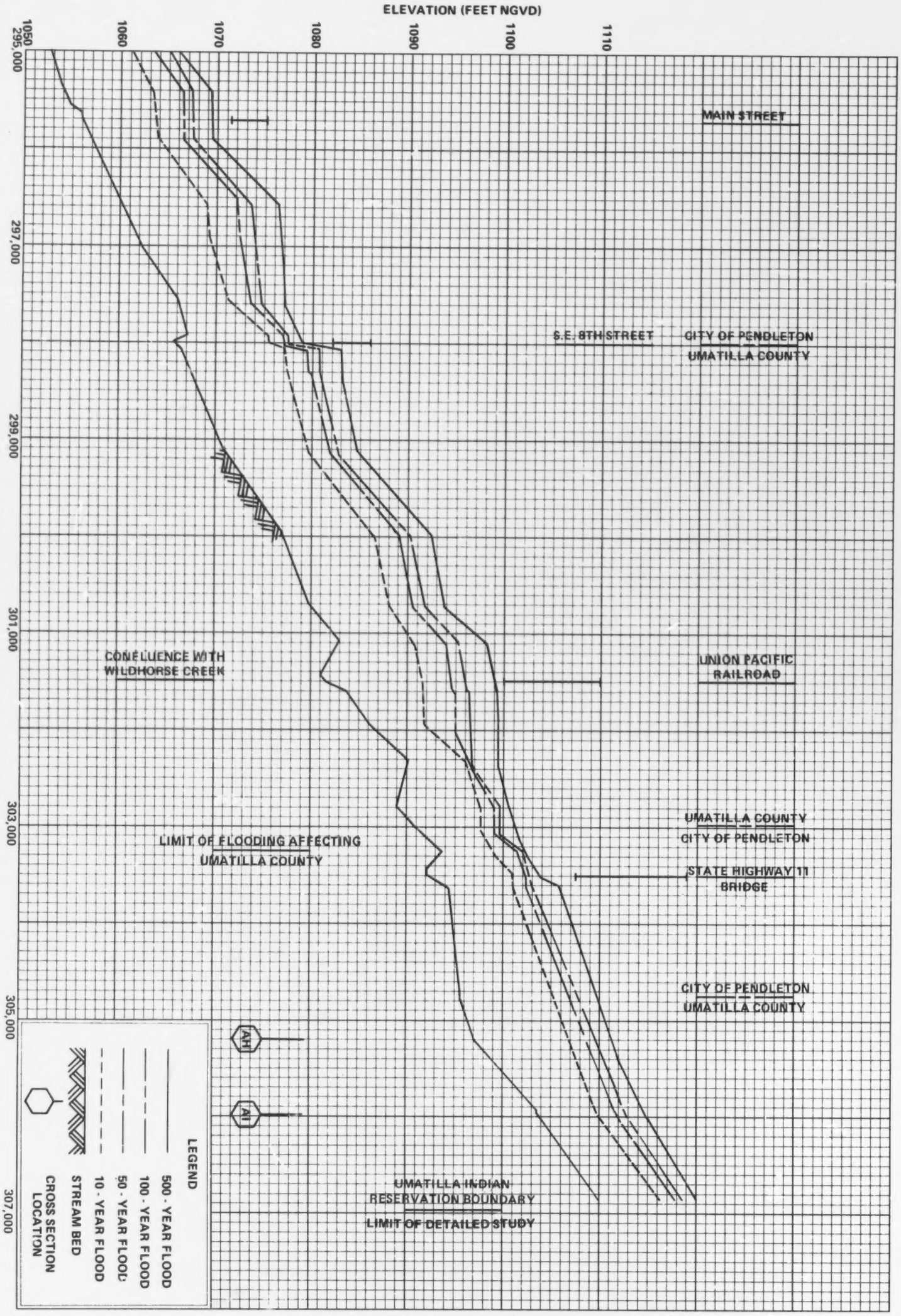

14P	FEDERAL EMERGENCY MANAGEMENT AGENCY UMATILLA COUNTY, OR (UNINCORPORATED AREAS)	FLOOD PROFILES UMATILLA RIVER

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ELEVATION (FEET NGVD)

575 580 585 590 595 600

3000

UMATILLA STREET
(HOOSIER ROAD)

UNION PACIFIC
RAILROAD

UNION PACIFIC
SPUR TRACK

LIMIT OF DETAILED STUDY

SHERMAN STREET

LIMIT OF FLOODING AFFECTING
UMATILLA COUNTY

4000

580 585 590 595 600

5500

LIMIT OF FLOODING AFFECTING
UMATILLA COUNTY

LIMIT OF FLOODING AFFECTING
UMATILLA COUNTY

6500

STREAM DISTANCE IN FEET ABOVE CONFLUENCE WITH UMATILLA RIVER

LEGEND

500 - YEAR FLOOD

100 - YEAR FLOOD

50 - YEAR FLOOD

10 - YEAR FLOOD

STREAM BED

CROSS SECTION LOCATION

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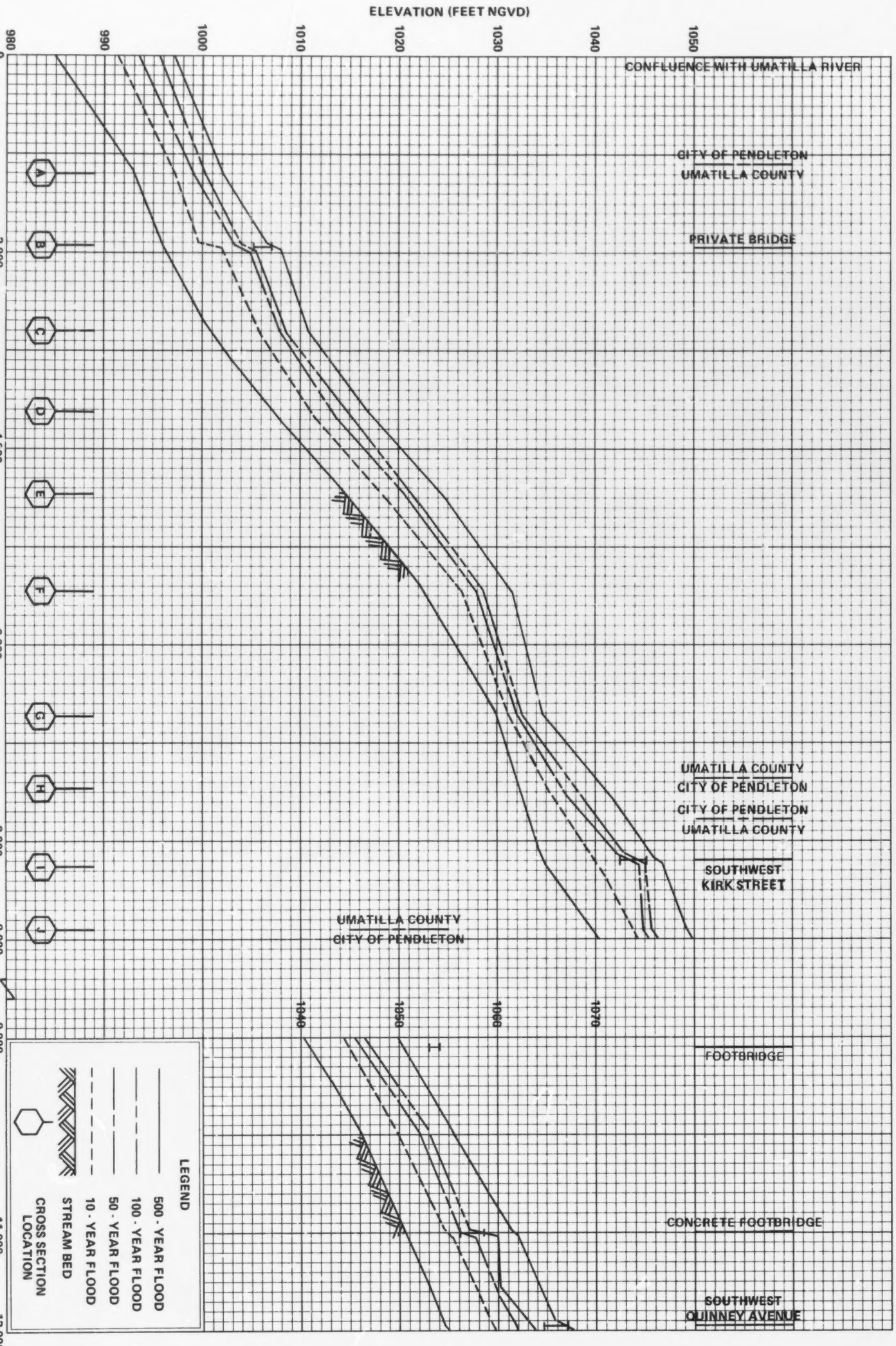
15P	FEDERAL EMERGENCY MANAGEMENT AGENCY UMATILLA COUNTY, OR (UNINCORPORATED AREAS)	FLOOD PROFILES STAGE GULCH



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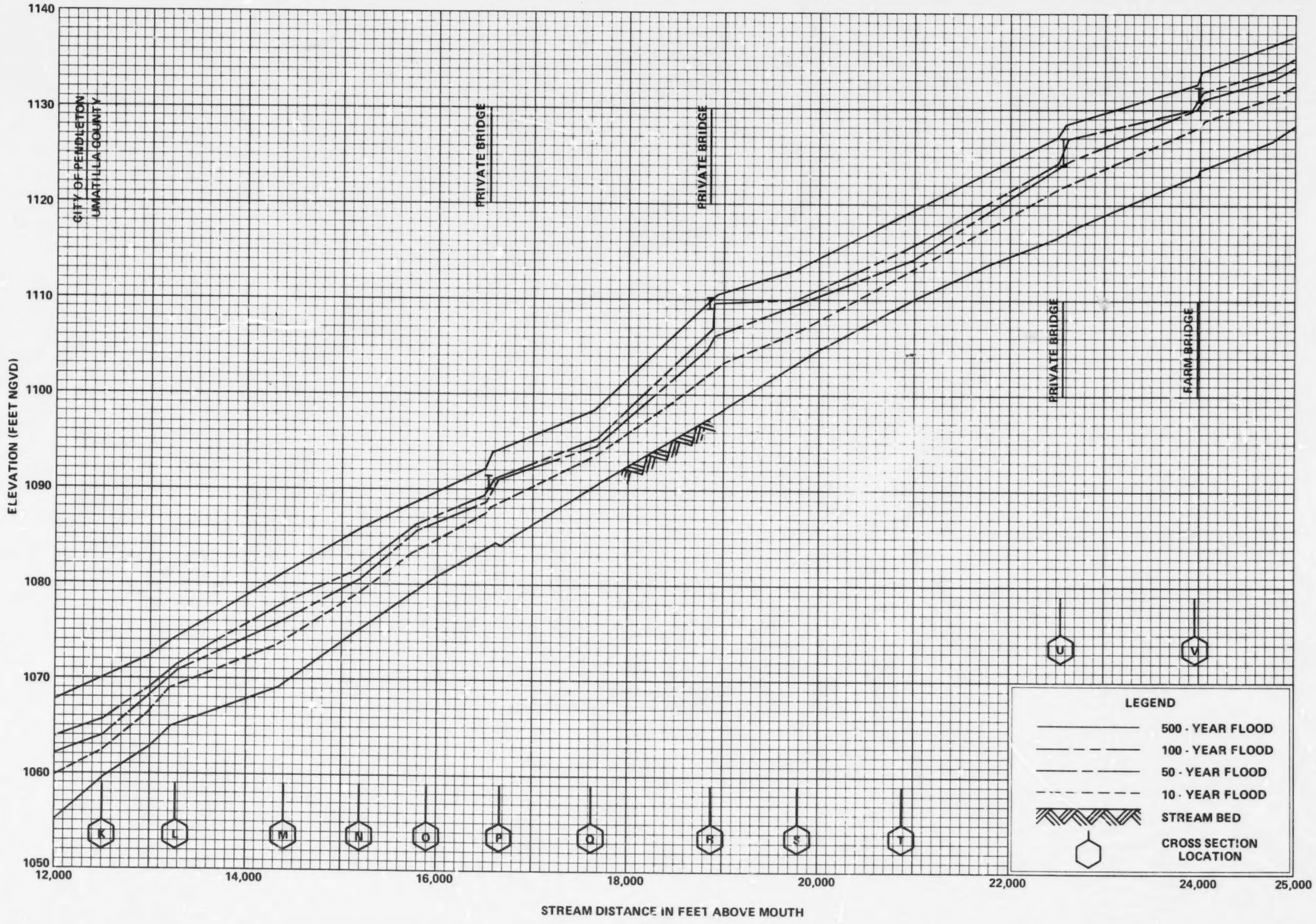
16P	FEDERAL EMERGENCY MANAGEMENT AGENCY UMATILLA COUNTY, OR (UNINCORPORATED AREAS)	FLOOD PROFILES McKAY CREEK



FLOOD PROFILES

McKAY CREEK

FEDERAL EMERGENCY MANAGEMENT AGENCY

UMATILLA COUNTY, OR
(UNINCORPORATED AREAS)

17P

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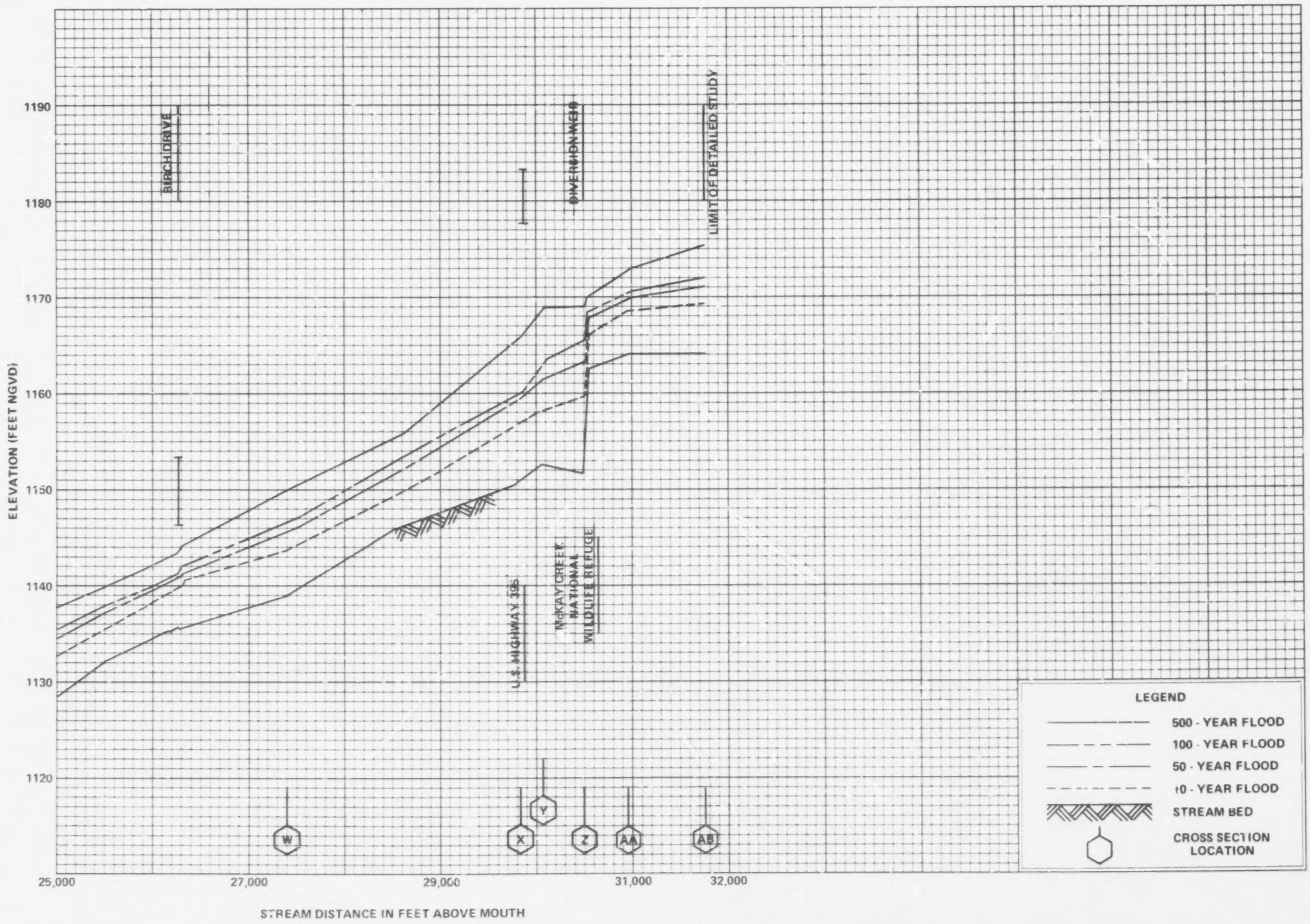

FLOOD PROFILES

McKAY CREEK

FEDERAL EMERGENCY MANAGEMENT AGENCY

UMATILLA COUNTY, OR
(UNINCORPORATED AREAS)

18P

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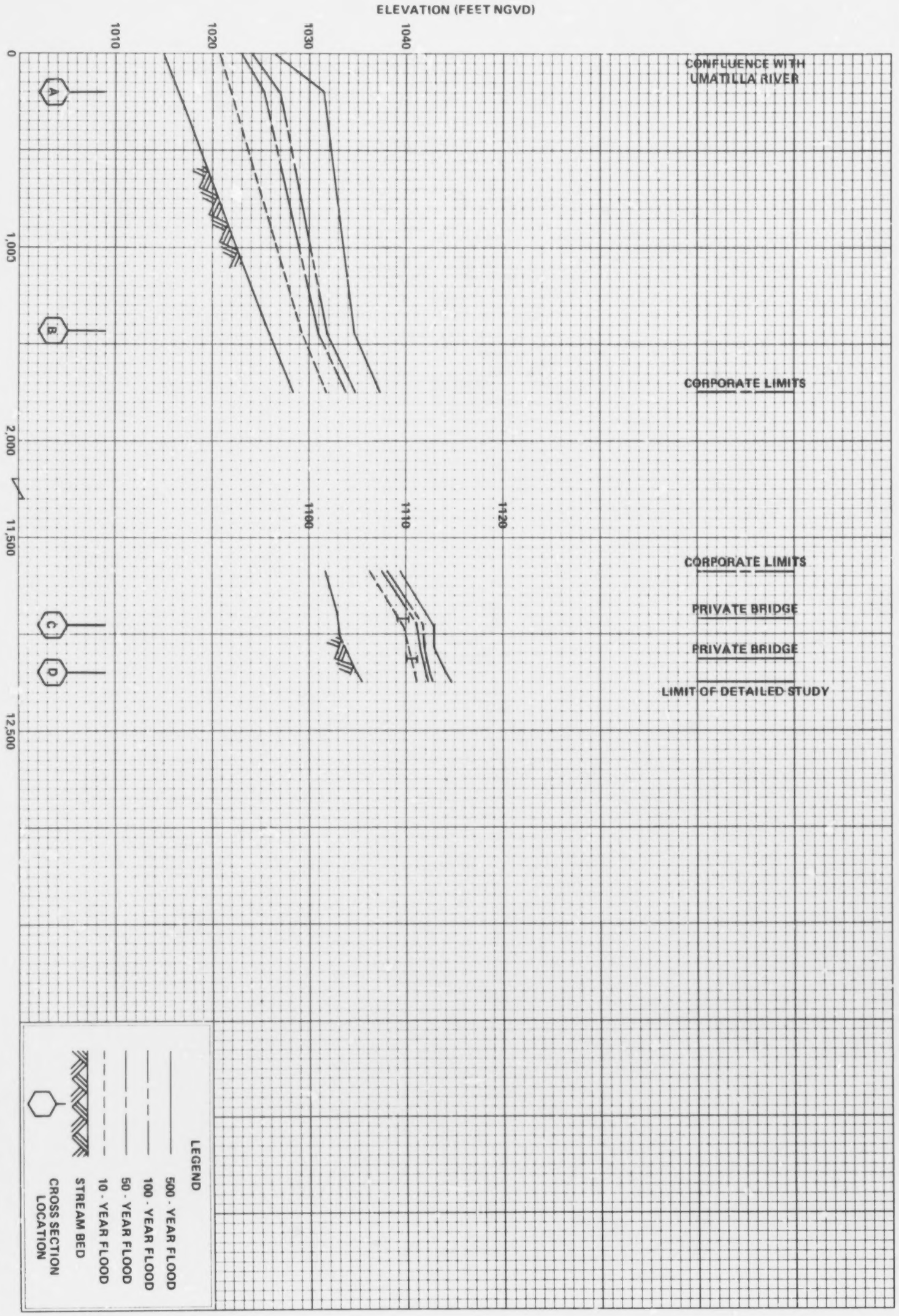

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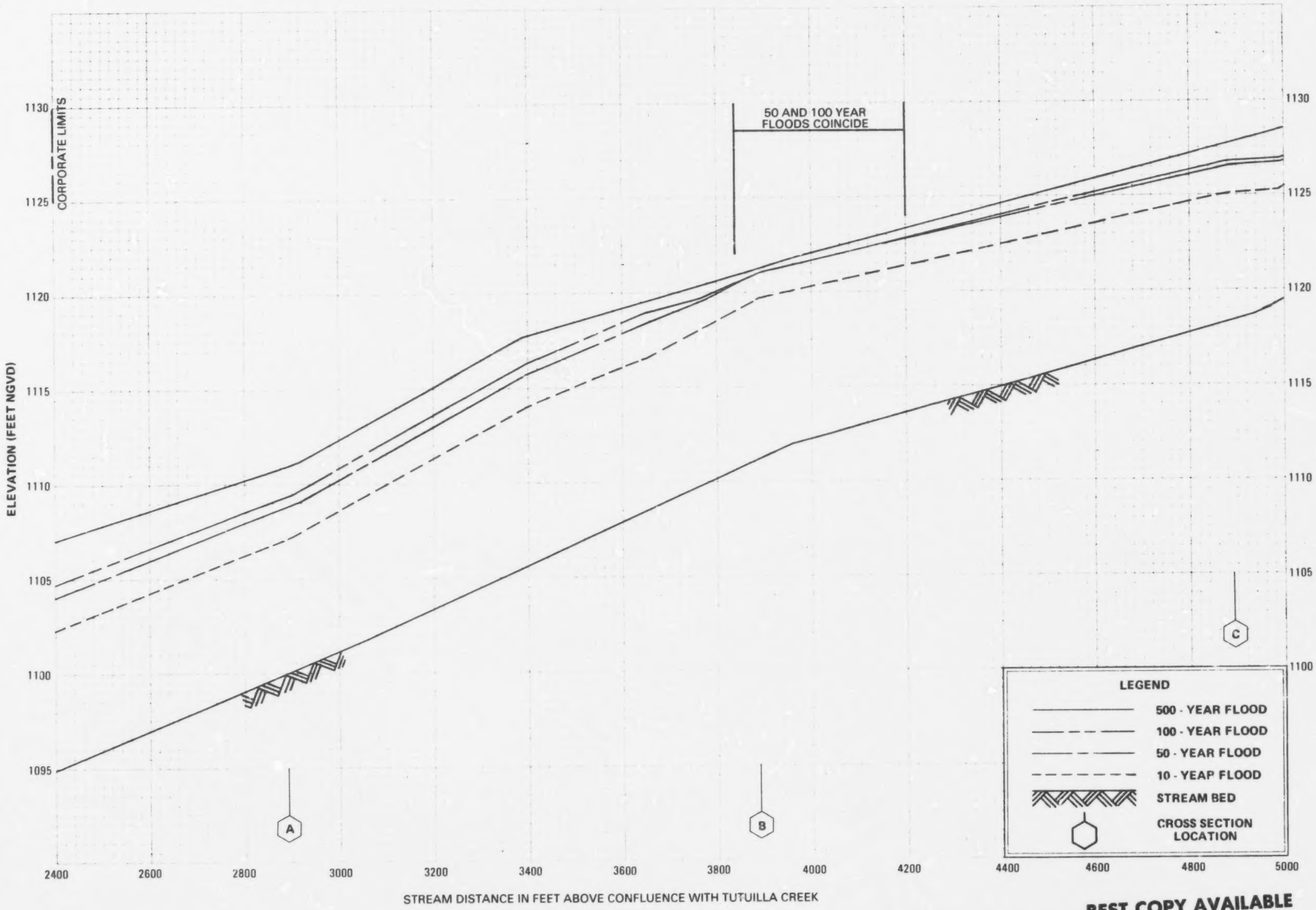
19P	FEDERAL EMERGENCY MANAGEMENT AGENCY UMATILLA COUNTY, OR (UNINCORPORATED AREAS)	FLOOD PROFILES TUTUILLA CREEK

50



FLOOD PROFILES

PATAWA CREEK

FEDERAL EMERGENCY MANAGEMENT AGENCY

UMATILLA COUNTY
UNINCORPORATED AREAS

20P

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50 AND 100 YEAR FLOODS COINCIDE

ELEVATION (FEET NGVD)

1155
1150
1145
1140
1135
1130
1125
1120

5000 5200 5400 5600 5800 6000 6200 6400 6600 6800 7000 7200 7400 7600

STREAM DISTANCE IN FEET ABOVE CONFLUENCE WITH TUTUILLA CREEK

D E F

LEGEND

- 500 - YEAR FLOOD
- 100 - YEAR FLOOD
- 50 - YEAR FLOOD
- 10 - YEAR FLOOD
- STREAM BED
- CROSS SECTION LOCATION

FLOOD PROFILES

PATAWA CREEK

FEDERAL EMERGENCY MANAGEMENT AGENCY
UMATILLA COUNTY
UNINCORPORATED AREAS

21P

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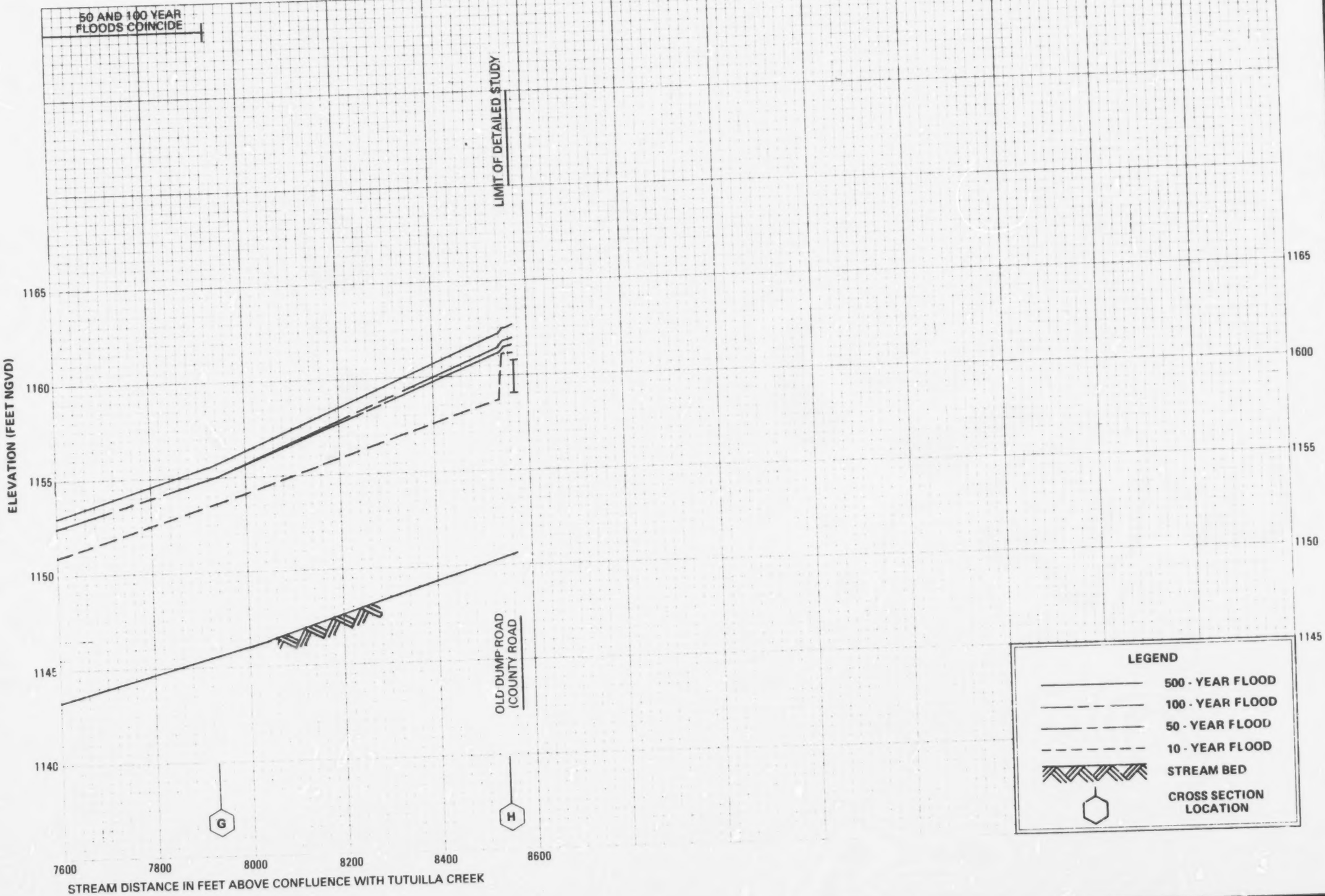

FLOOD PROFILES

PATAWA CREEK

FEDERAL EMERGENCY MANAGEMENT AGENCY

UMATILLA COUNTY
UNINCORPORATED AREAS

22P

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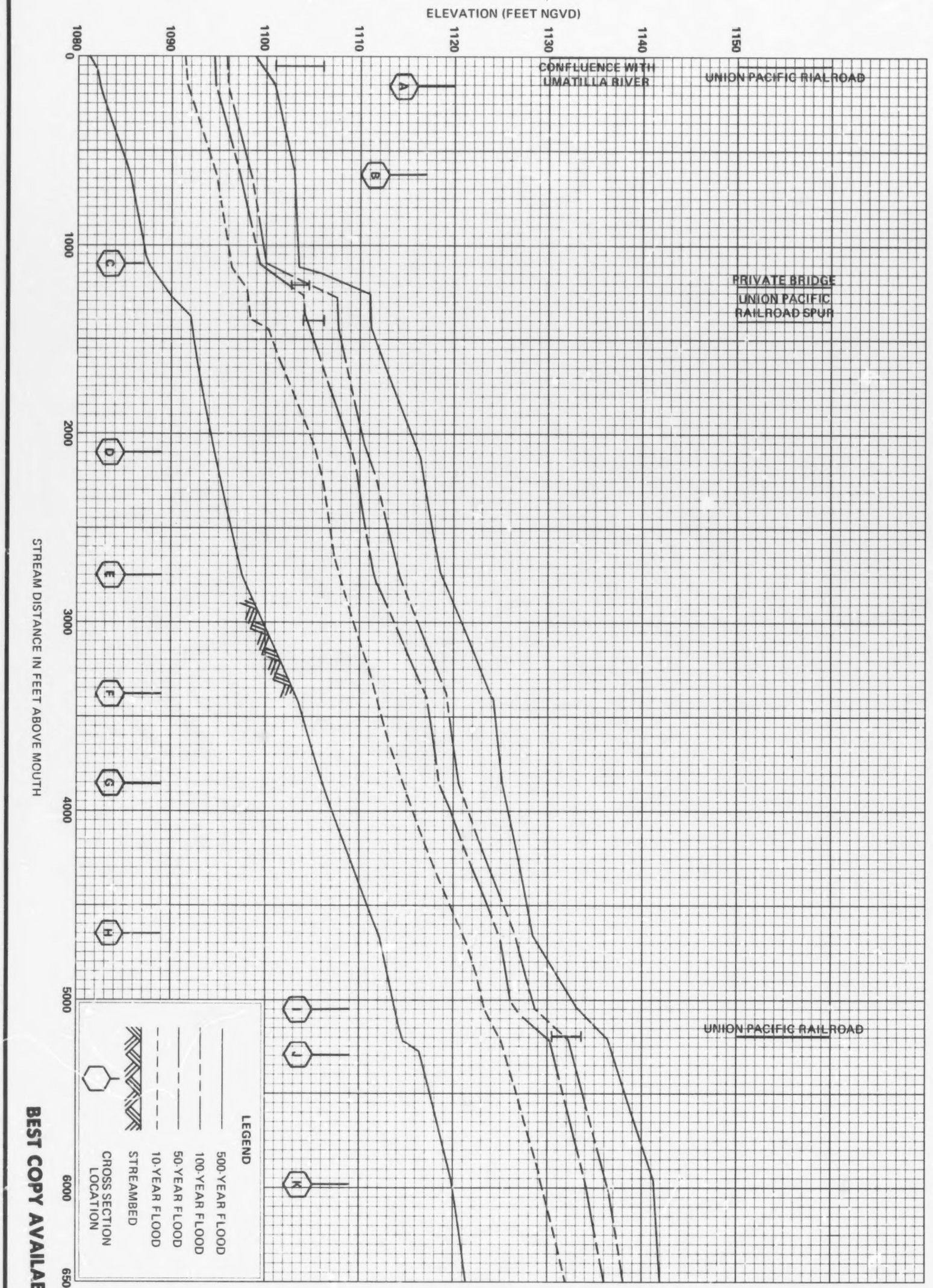

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23P

FEDERAL EMERGENCY MANAGEMENT AGENCY

UMATILLA COUNTY, OR
(UNINCORPORATED AREAS)

FLOOD PROFILES

WILDHORSE CREEK

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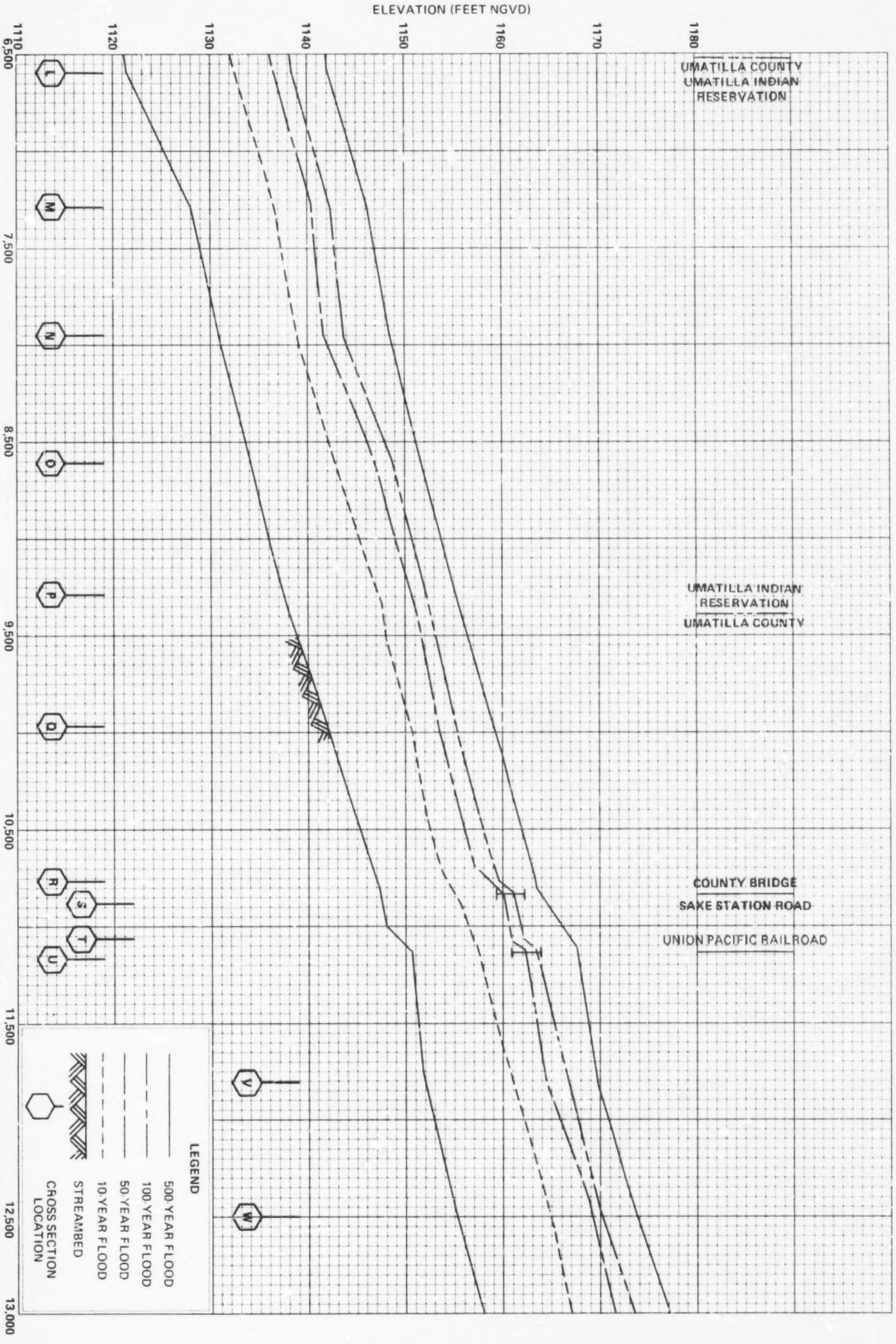

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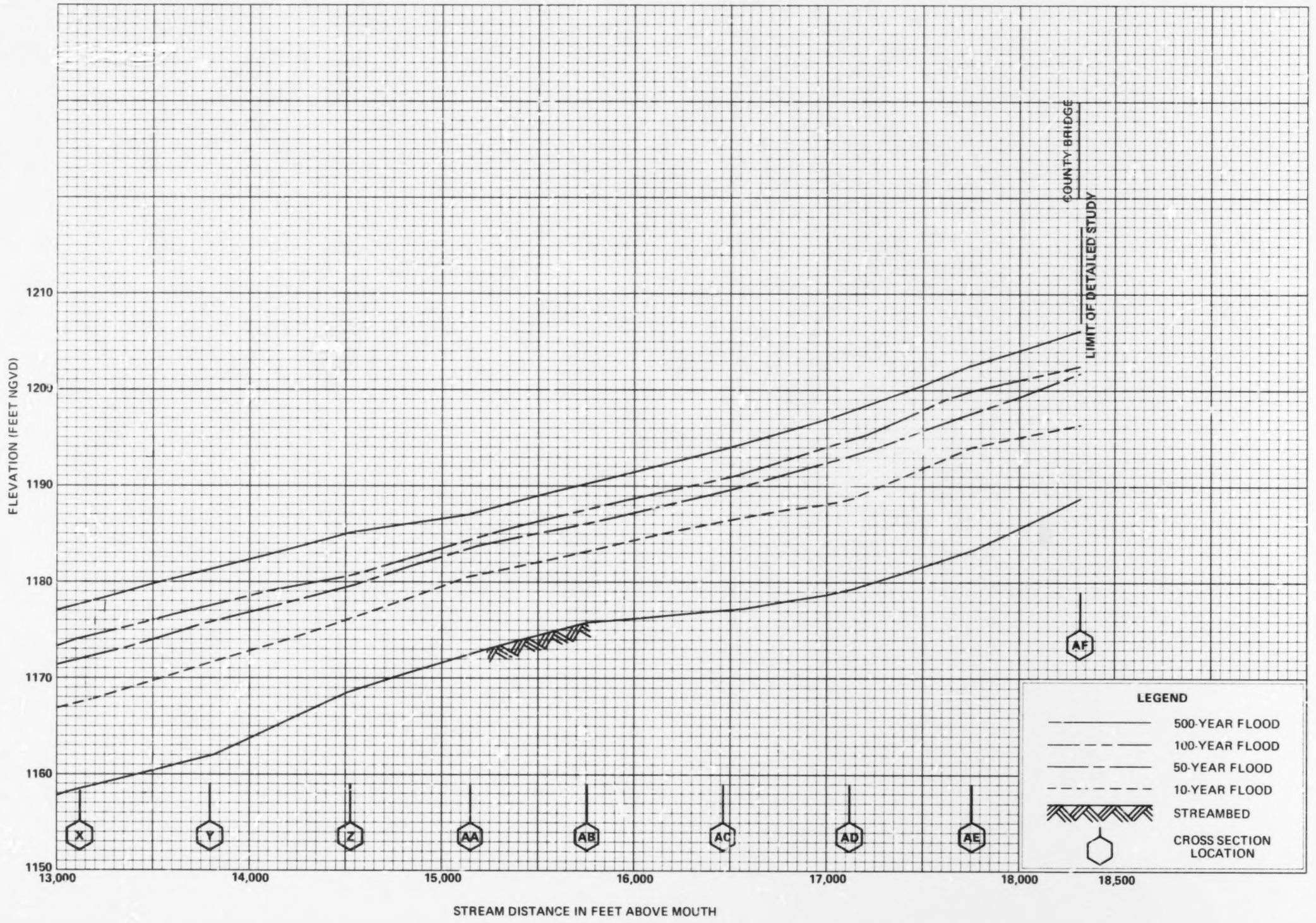
FEDERAL EMERGENCY MANAGEMENT AGENCY

UMATILLA COUNTY, OR
(UNINCORPORATED AREAS)

FLOOD PROFILES

WILDHORSE CREEK



FLOOD PROFILES

WILDHORSE CREEK

FEDERAL EMERGENCY MANAGEMENT AGENCY

UMATILLA COUNTY, OR
(UNINCORPORATED AREAS)

25P

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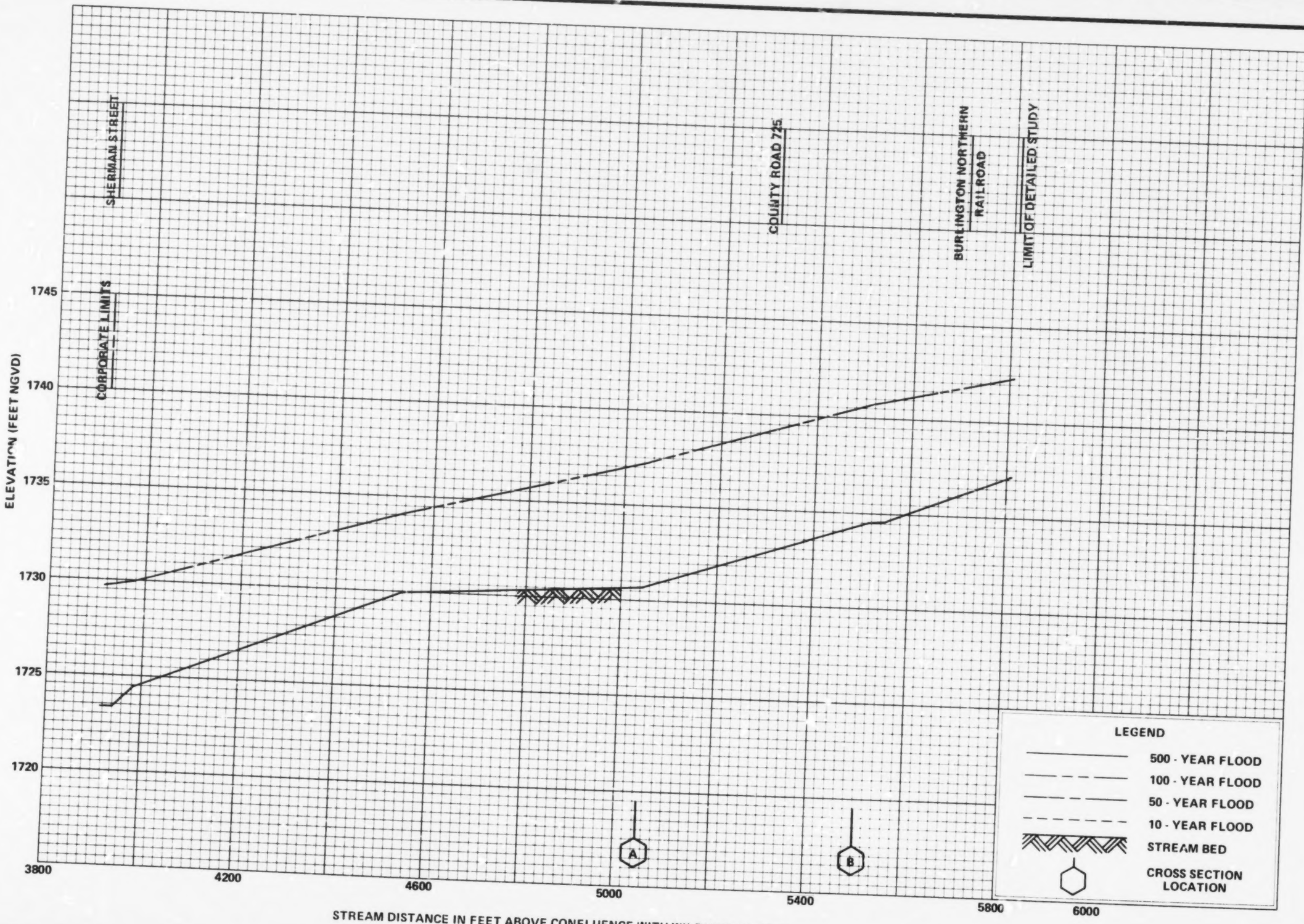

FLOOD PROFILES

WATERMAN GULCH

FEDERAL EMERGENCY MANAGEMENT AGENCY

UMATILLA COUNTY, OR
(UNINCORPORATED AREAS)

26P

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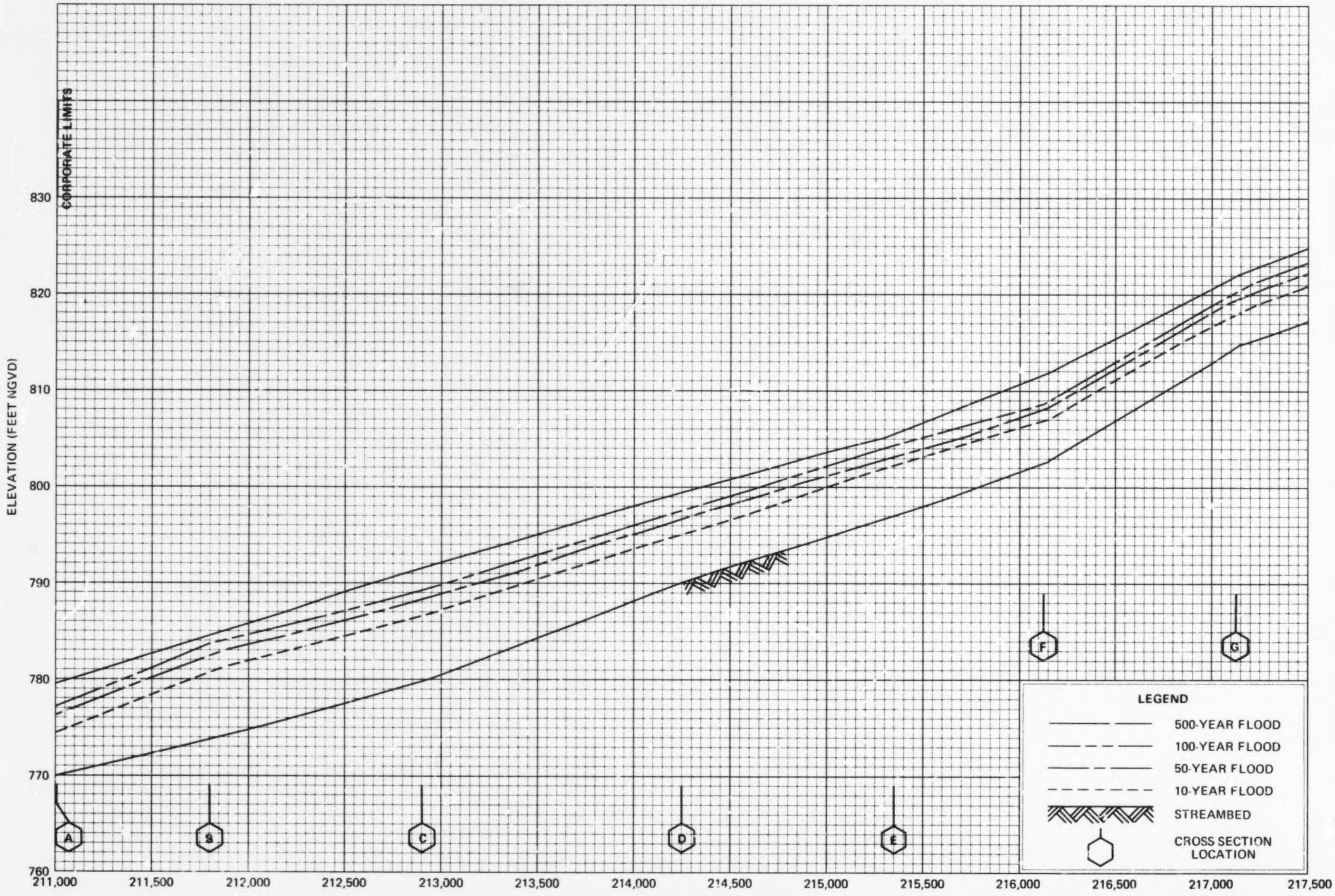

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FLOOD PROFILES

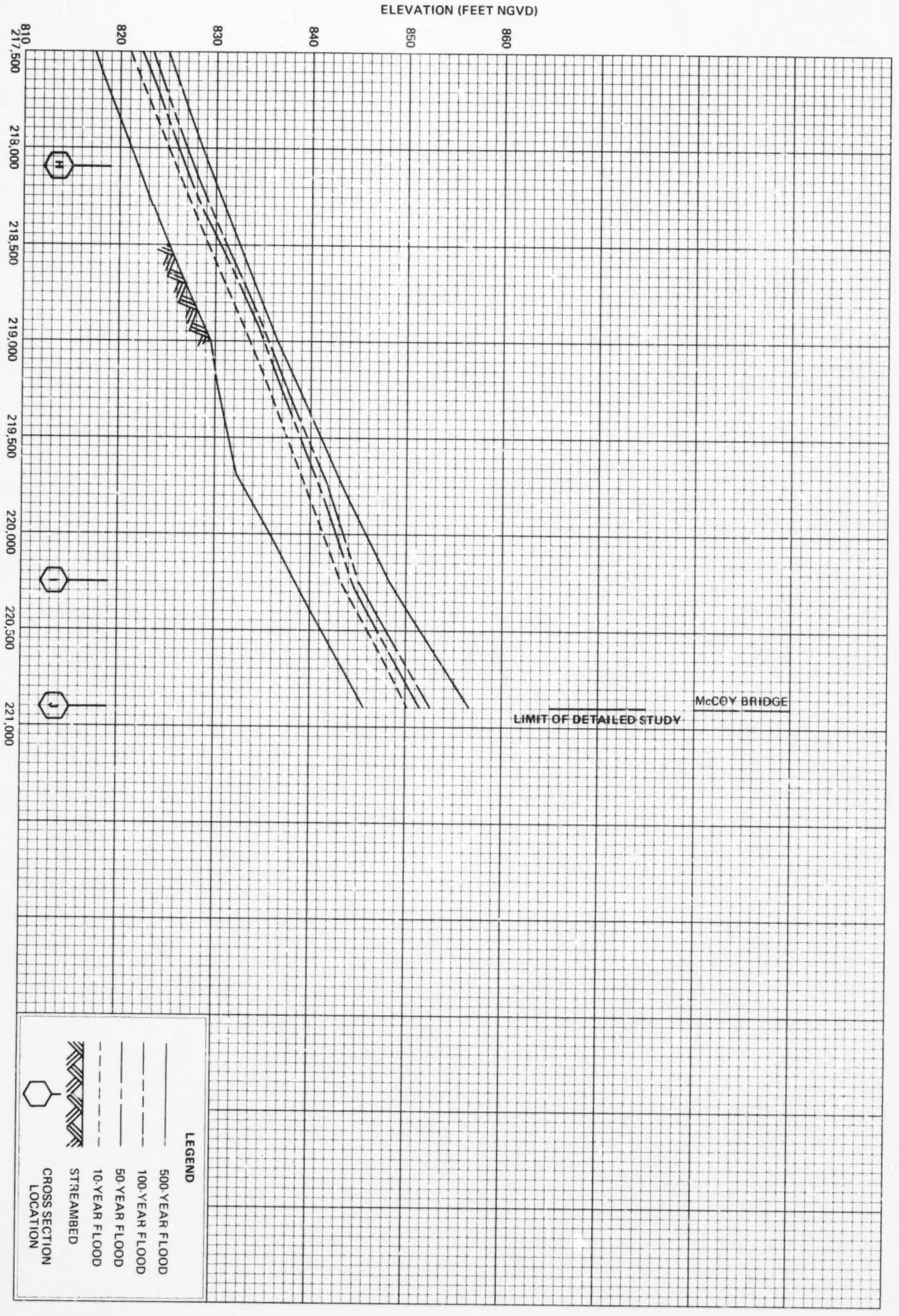
WALLA WALLA RIVER

FEDERAL EMERGENCY MANAGEMENT AGENCY

UMATILLA COUNTY, OR

(UNINCORPORATED AREAS)

27P



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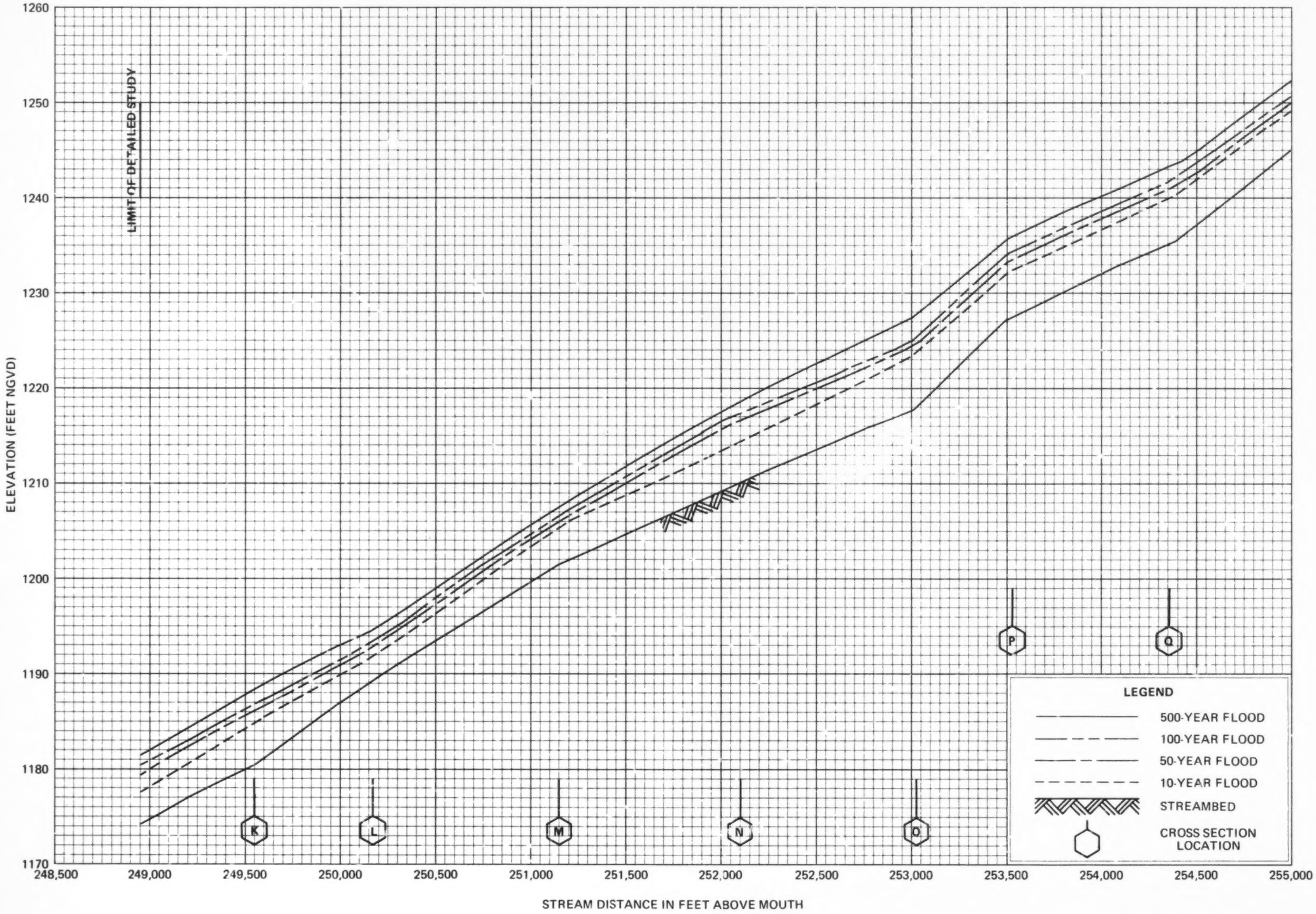
28P	FEDERAL EMERGENCY MANAGEMENT AGENCY UMATILLA COUNTY, OR (UNINCORPORATED AREAS)	FLOOD PROFILES WALLA WALLA RIVER

59



FLOOD PROFILES

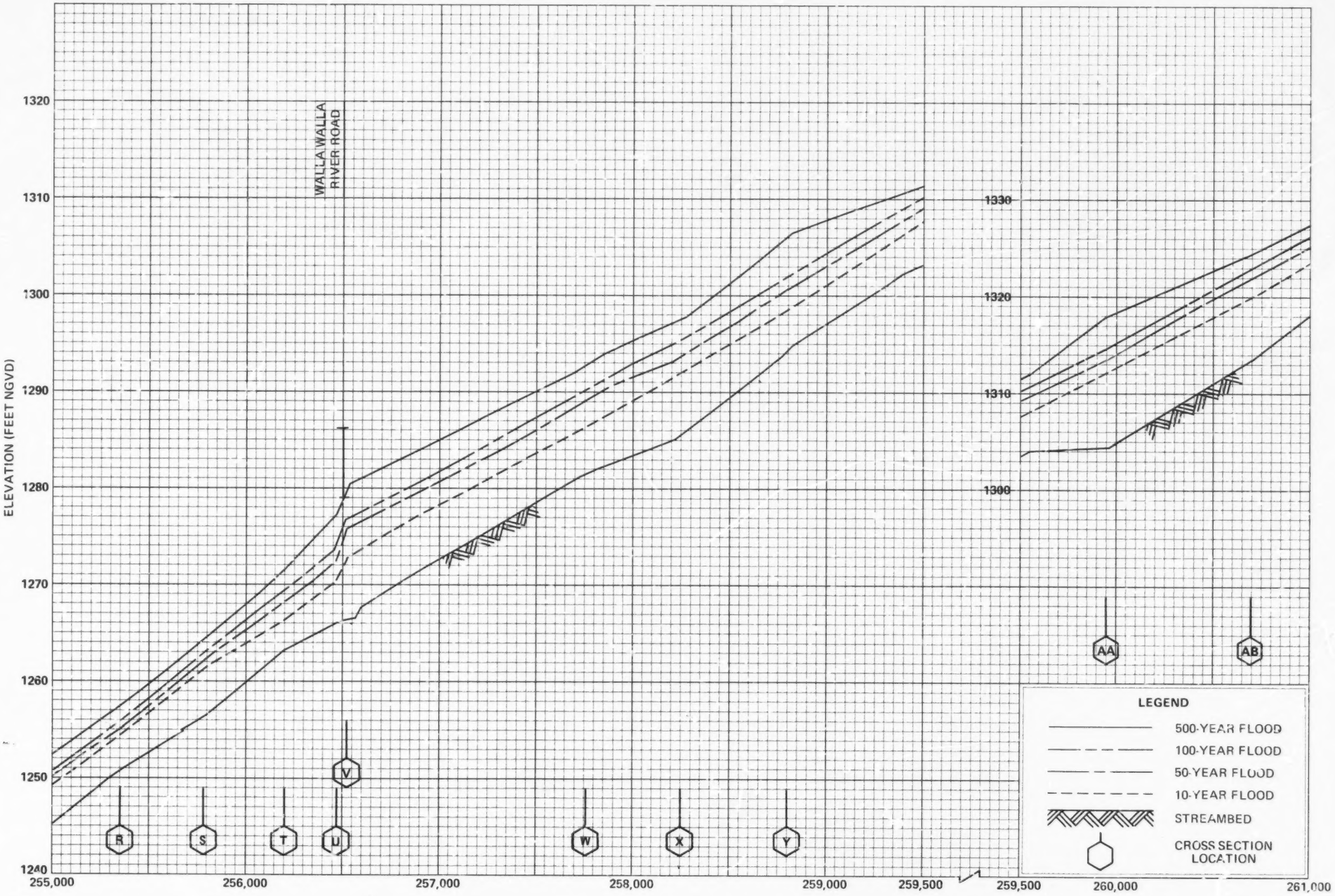
WALLA WALLA RIVER

FEDERAL EMERGENCY MANAGEMENT AGENCY

UMATILLA COUNTY, OR
(UNINCORPORATED AREAS)

29P

BEST COPY AVAILABLE



FLOOD PROFILES

WALLA WALLA RIVER

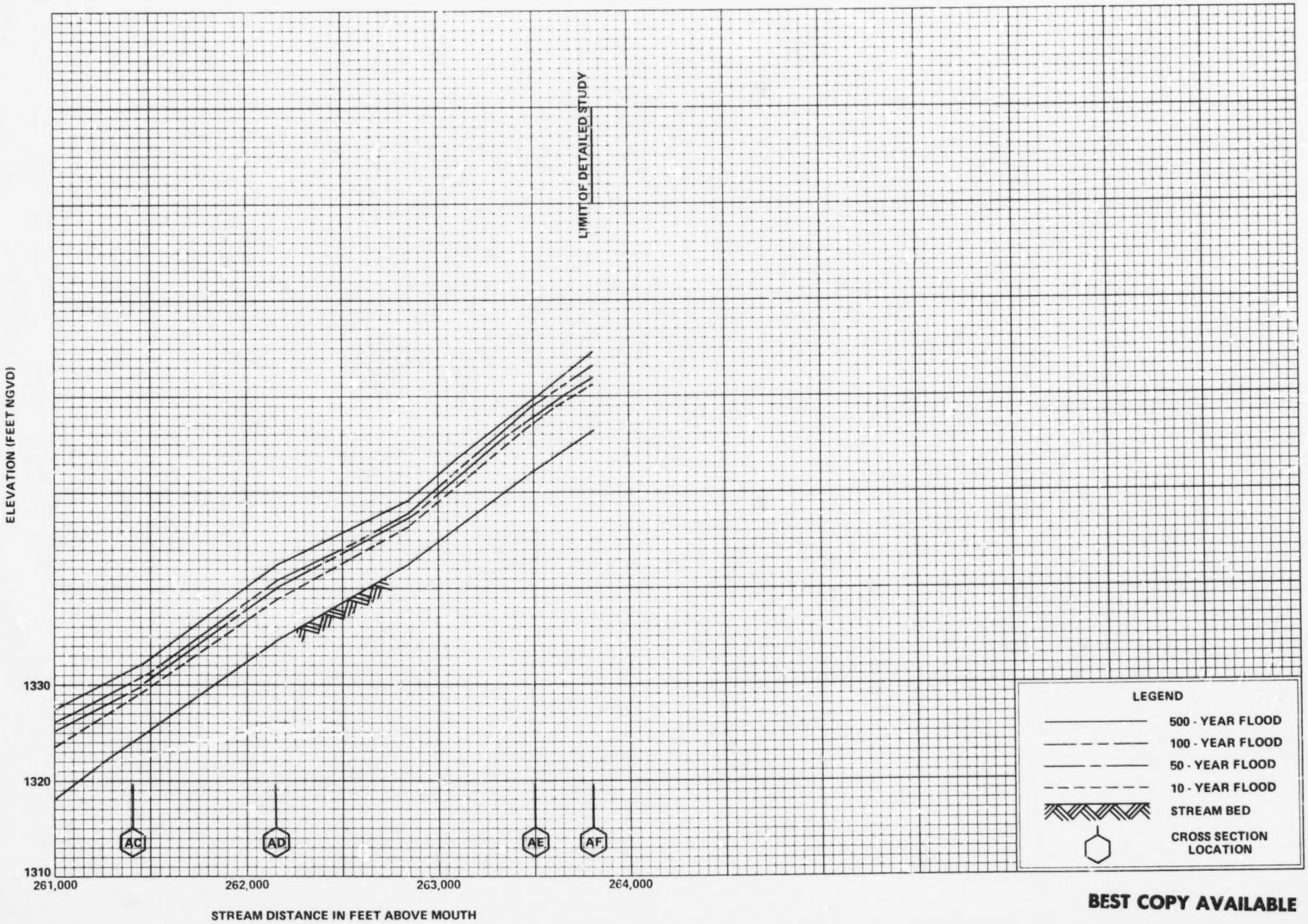
FEDERAL EMERGENCY MANAGEMENT AGENCY

UMATILLA COUNTY, OR

(UNINCORPORATED AREAS)

30P

BEST COPY AVAILABLE



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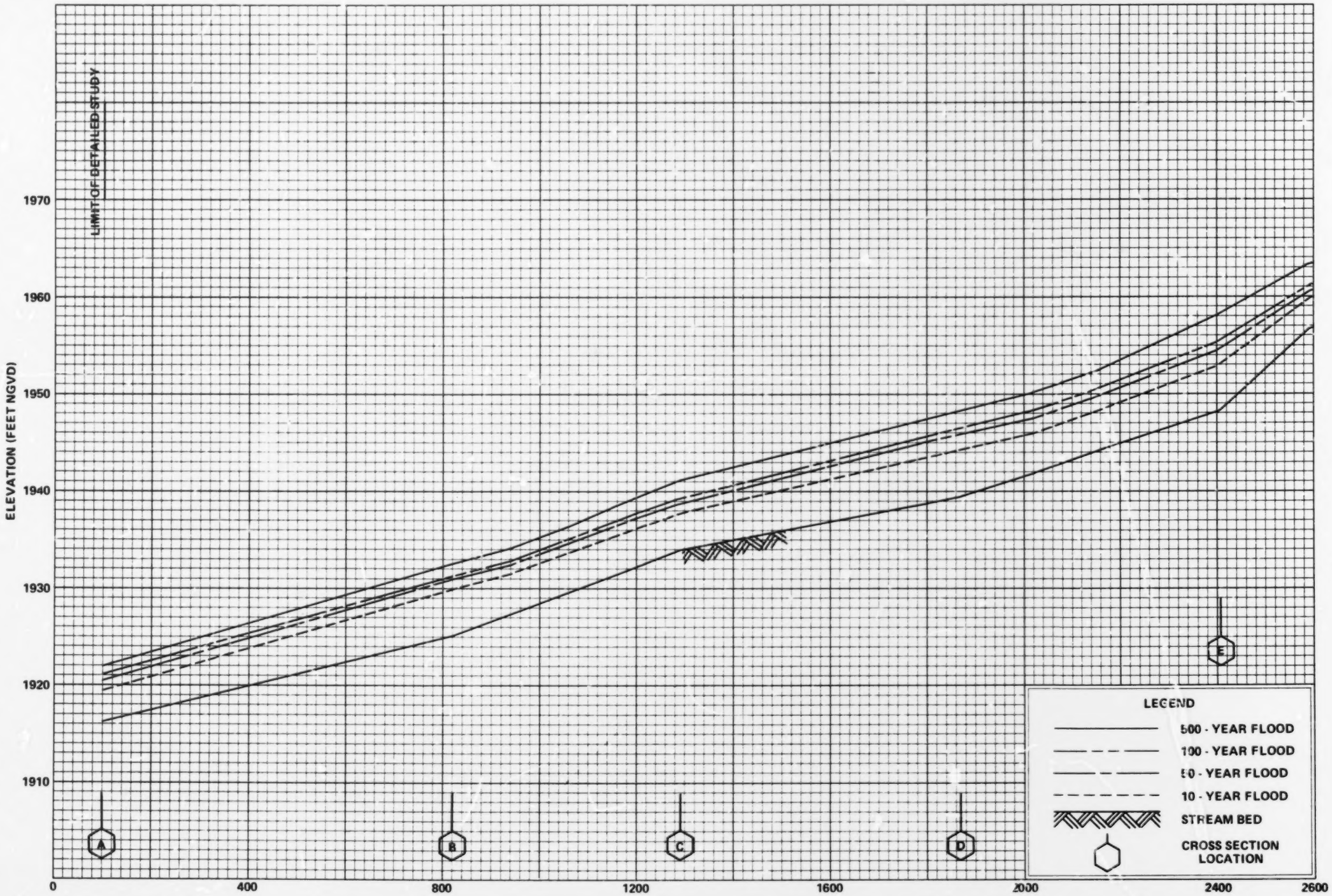
FLOOD PROFILES

WALLA WALLA RIVER

FEDERAL EMERGENCY MANAGEMENT AGENCY

UMATILLA COUNTY, OR
(UNINCORPORATED AREAS)



FLOOD PROFILES

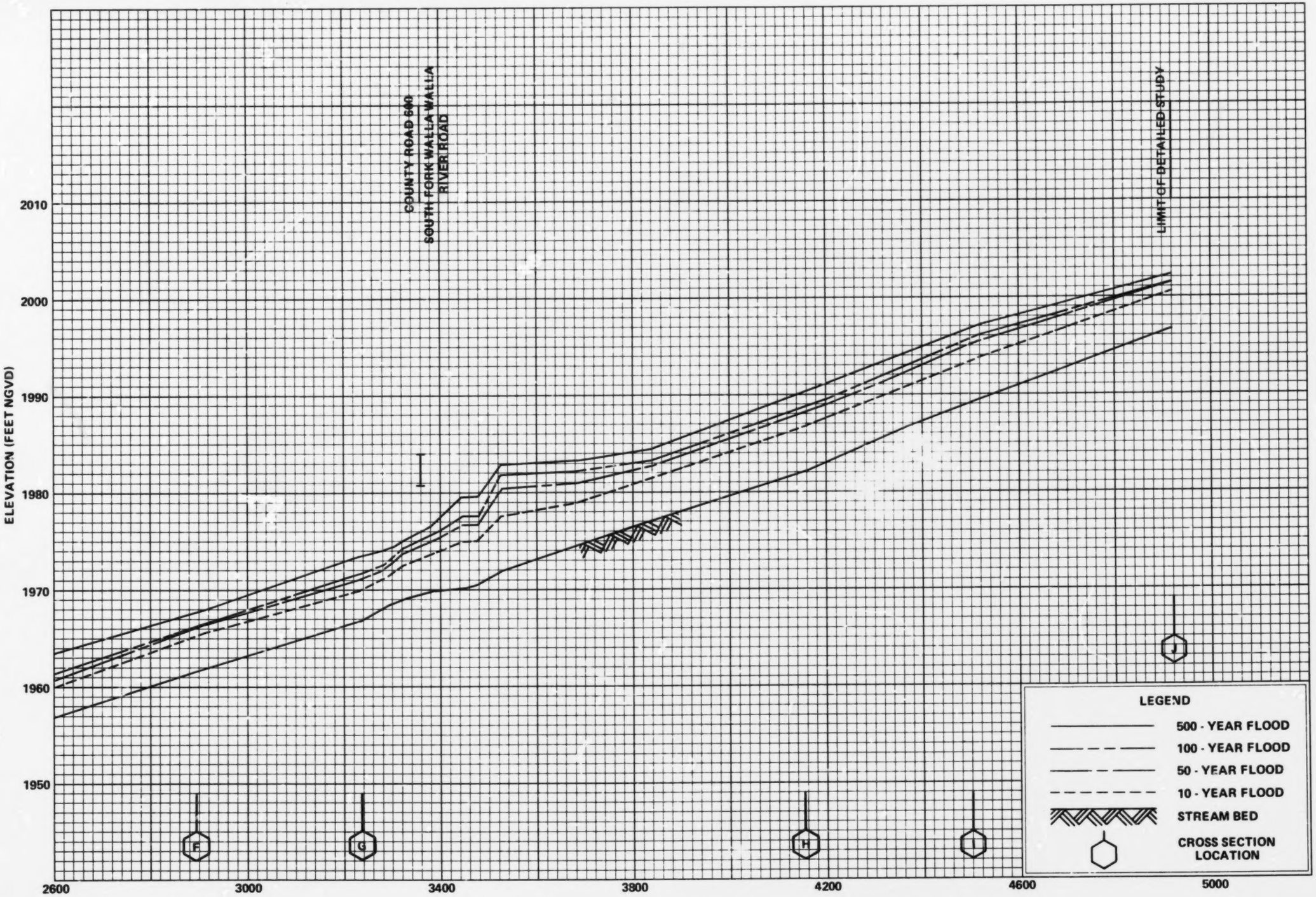
SOUTH FORK WALLA WALLA RIVER

FEDERAL EMERGENCY MANAGEMENT AGENCY

UMATILLA COUNTY, OR
(UNINCORPORATED AREAS)

32P

BEST COPY AVAILABLE



FLOOD PROFILES

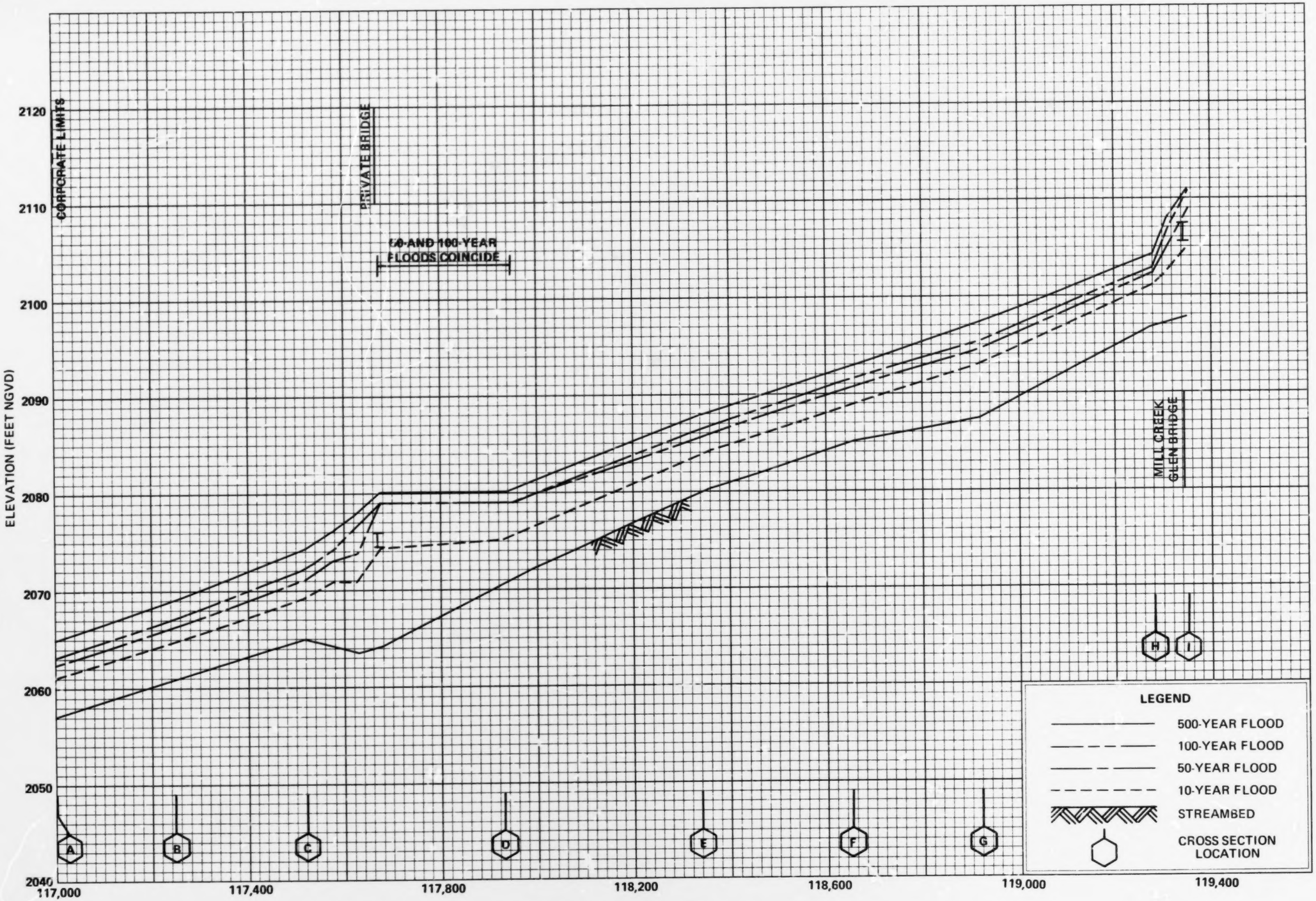
SOUTH FORK WALLA WALLA RIVER

FEDERAL EMERGENCY MANAGEMENT AGENCY

UMATILLA COUNTY, OR
(UNINCORPORATED AREAS)

33P

BEST COPY AVAILABLE



FLOOD PROFILES

MILL CREEK

FEDERAL EMERGENCY MANAGEMENT AGENCY

UMATILLA COUNTY, OR
(UNINCORPORATED AREAS)

34P

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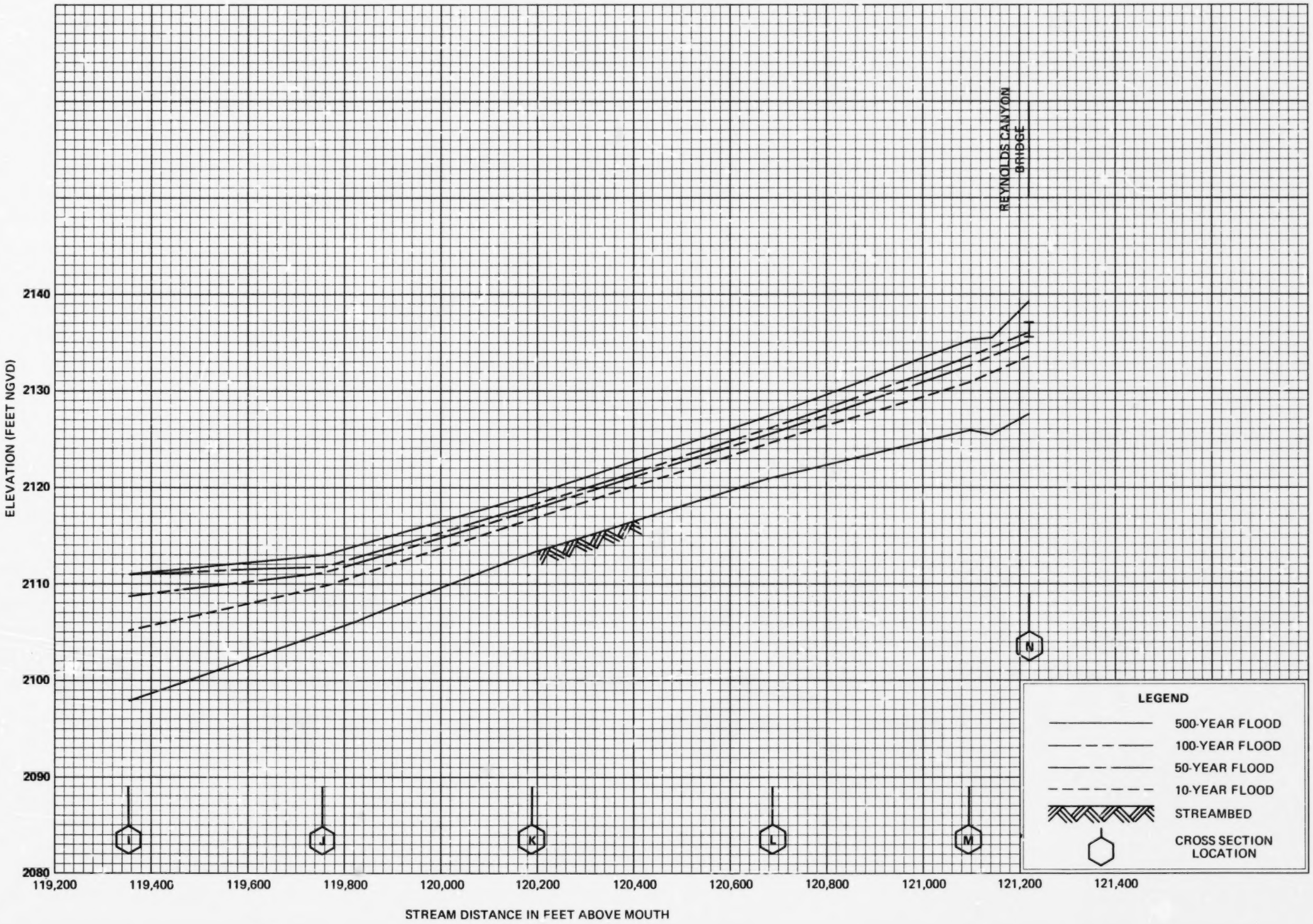


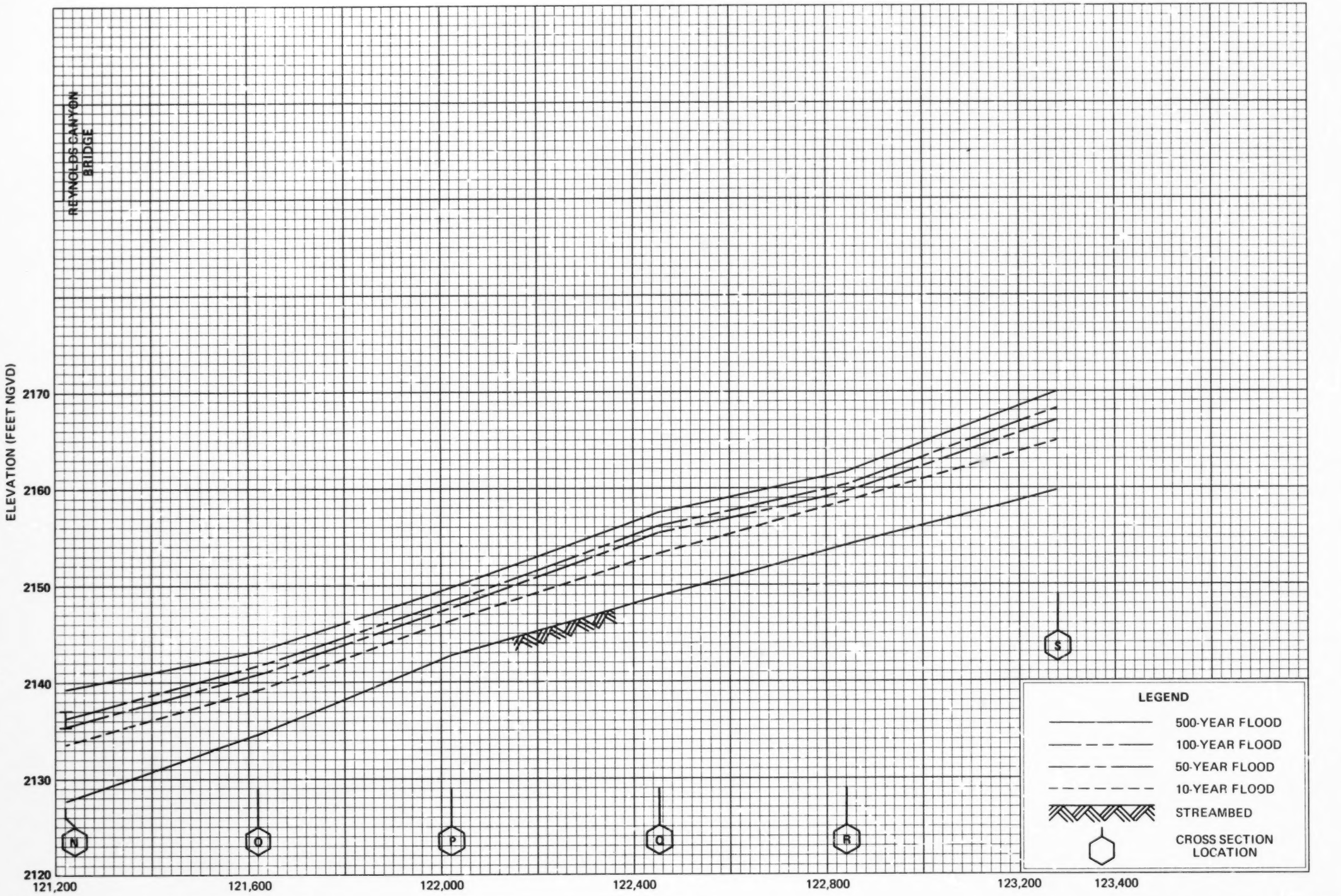
FLOOD PROFILES

MILL CREEK

FEDERAL EMERGENCY MANAGEMENT AGENCY

UMATILLA COUNTY, OR
(UNINCORPORATED AREAS)

35P



FLOOD PROFILES

MILL CREEK

FEDERAL EMERGENCY MANAGEMENT AGENCY

UMATILLA COUNTY, OR
(UNINCORPORATED AREAS)

36P

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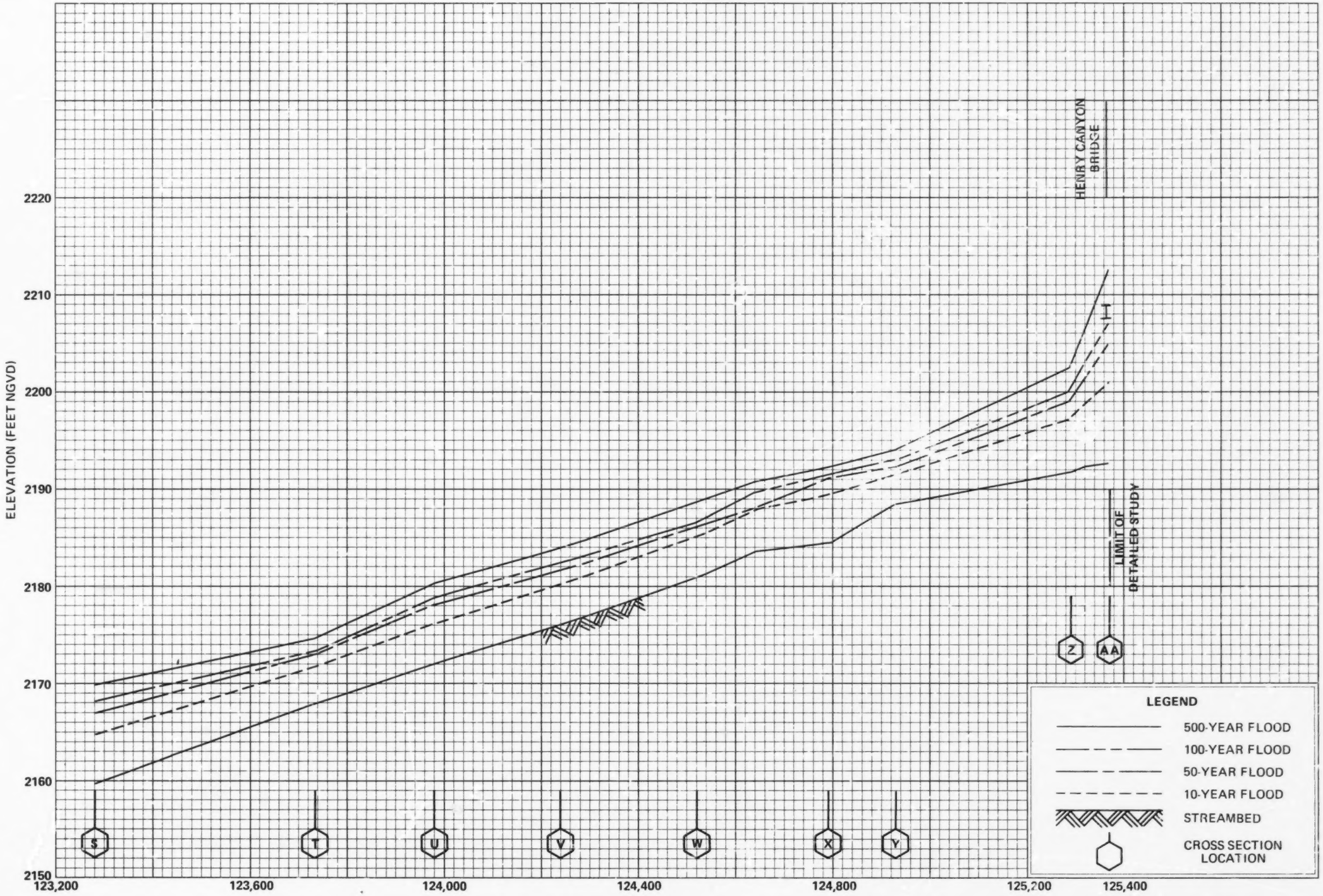


FLOOD PROFILES

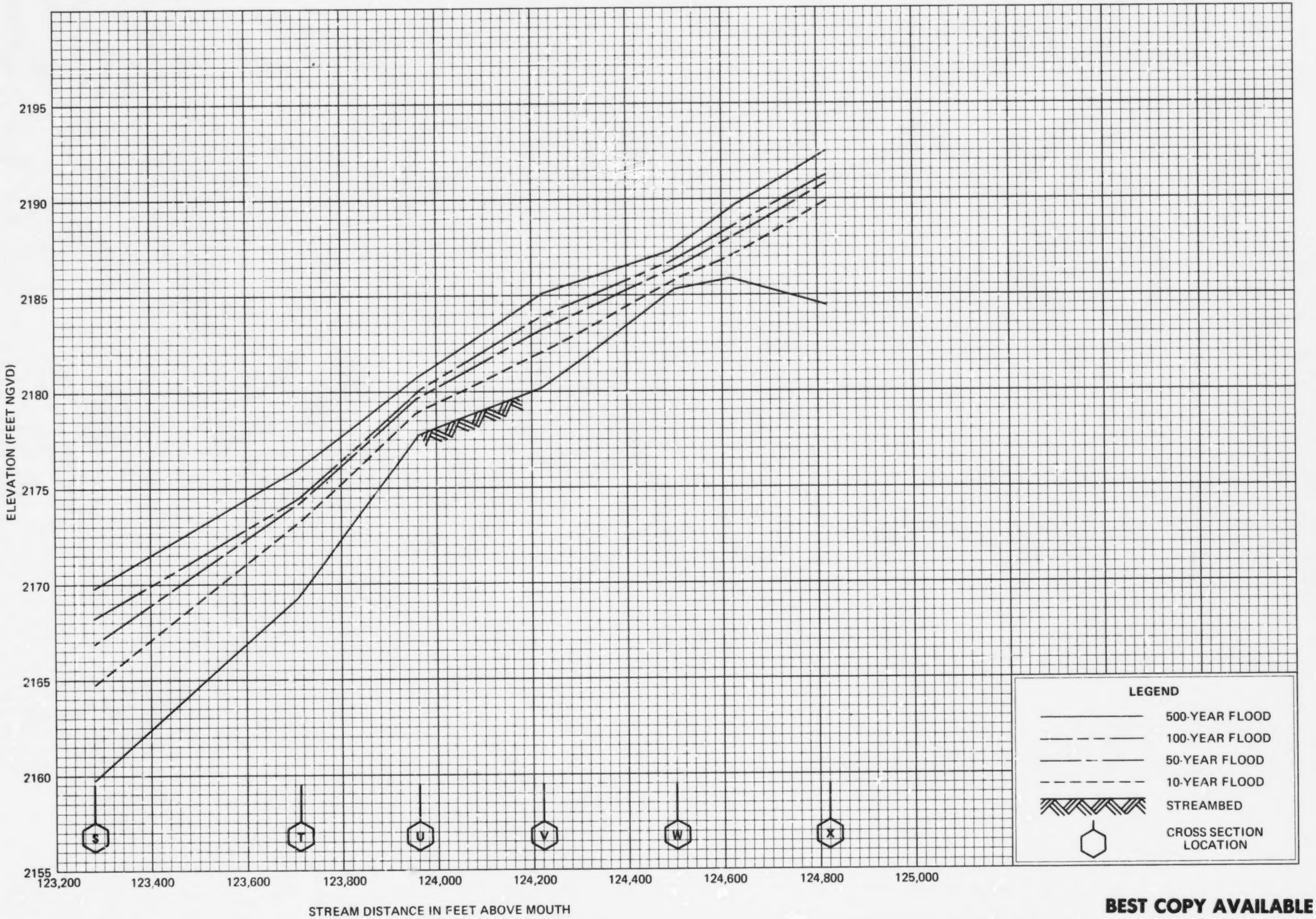
MILL CREEK

FEDERAL EMERGENCY MANAGEMENT AGENCY

UMATILLA COUNTY, OR
(UNINCORPORATED AREAS)

37P

BEST COPY AVAILABLE



FLOOD PROFILES

MILL CREEK (SIDE CHANNEL)

FEDERAL EMERGENCY MANAGEMENT AGENCY

UMATILLA COUNTY, OR
(UNINCORPORATED AREAS)

38P

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Exhibit 3 - Elevation Reference Marks

REFERENCE MARK	FIRM PANEL	ELEVATION (FEET NGVD)	DESCRIPTION OF LOCATION
RM1	0040	330.93	A standard disk, stamped D 114 1934, approximately 1.4 miles southeast along the Union Pacific Railroad from the station at Umatilla, at concrete irrigation culvert 184.34, in the top of the west headwall, 17.5 feet of west the centerline of the track.
RM2	0040	401.44	A standard disk, stamped C 114 1934, set in the top of a concrete post, approximately 3.5 miles northwest along the Union Pacific Railroad from the station at Hermiston, approximately 975 feet southeast of milepost 186, approximately 180 feet southeast of Oregon Trail (U.S. 30) milepost 194, approximately 165 feet southeast of culvert 186.20, approximately 75 feet southwest of the centerline of the track.
RM3	0365	592.76	A U.S. Geological Survey standard cap, stamped 500 A, riveted on the top of a 4.5-inch iron pipe projecting approximately 1 foot above ground, approximately 5.8 miles southwest along the Union Pacific Railroad from the station at Hermiston, 0.5 mile northwest of the station at Hinkle, approximately 680 feet east of milepost 194, approximately 600 feet east of the northeast corner of a right-of-way fence, and 55 feet northeast of the centerline of abandoned railroad grade in open pasture.
RM4	0375	618.90	A standard disk, stamped Z 113 1934, set in the top of a concrete post, approximately 3.9 miles northwest along the Union Pacific Railroad from the station at Stanfield, approximately 0.25 mile west of milepost 185, 240 feet west of culvert 184.76, 49 feet north of the centerline of the track, 1 foot south of the right-of-way fence.

Exhibit 3 - Elevation Reference Marks (Cont'd)

REFERENCE MARK	FIRM PANEL	ELEVATION (FEET NGVD)	DESCRIPTION OF LOCATION
RM5	0725	637.56	A standard disk, stamped Z 113 1934, set in the top of a concrete post 68.5 feet northwest of the northwest end of the Union Pacific Railroad station at Echo, approximately 350 feet southeast of milepost 192, and 47.5 feet northeast of the centerline of the main track.
RM6	0725	709.94	A standard disk, stamped U 113 1934, approximately 2.0 miles west along the Union Pacific Railroad from the station at Nolin, approximately 625 feet southeast of semaphore 1966, 37 feet northwest of the centerline of the track, set in the top of the northwest retaining wall of concrete irrigation culvert 196.5.
RM7	0750	787.16	An Oregon State Engineering Department standard disk, stamped S 113 1934, set in top of south concrete abutment of county road bridge over Umatilla River, approximately 0.3 mile east of Union Pacific Railroad station at Yoakum, approxi-mately 550 feet northeast of railroad milepost 202, 450 feet north of the centerline of the track.
RM8	0775	855.20	A Pacific Power and Light Company standard disk, stamped 855.204 Q 113 1928, set in top of east concrete abutment of steel bridge 204.91 over Umatilla River, approximately 1.4 miles east along the Union Pacific Railroad from the station sign at Campbell, approximately 180 feet west of milepost 205, and 7.3 feet north of the centerline of the track.

Exhibit 3 - Elevation Reference Marks (Cont'd)

REFERENCE MARK	FIRM PANEL	ELEVATION (FEET NGVD)	DESCRIPTION OF LOCATION
RM9	0775	897.00	A standard disk, stamped N 113 1934, set in the top of a concrete post approximately 1.4 miles west of Union Pacific Railroad station at Barnhart, approxi-mately 190 feet southwest of milepost 207, 48.8 feet south of the centerline of the track, 37.5 feet east of the center of a wagon gate in the right-of-way fence, and 1.2 feet north of the fence.
RM10	0775	940.23	A Pacific Power and Light Company standard disk, stamped 940.227 M 113 1928, set in the concrete base of an abandoned semaphore, approximately 1.9 miles west along old U.S. Highway 30 from the post office at Rieth, 138 feet northeast of highway mile-post 225, 15.4 feet south of the centerline of the highway.
RM11	0825	1214.71	Top of a concrete post projected 0.4 foot above the ground at Mission Railroad crossing over Mission Road, 5 miles east along Union Pacific Railroad tracks from the station in Pendleton, 145.2 feet southwest across the track from mile post 221, 63.5 feet southeast of the center of the main track and centerline of Mission Road crossing.
RM12	0825	1279.43	Top of a concrete post flush with ground 1.9 miles east along Union Pacific Railroad tracks from the crossing and signboard in Mission, 67.5 feet south-west of the southwestern corner of culvert 222.86.

*U.S. GOVERNMENT PRINTING OFFICE: 1988-201-724/60653